STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

JENNIFER COHAN
SECRETARY

VIA WEBSITE POSTING

August 31, 2020

Contract No. T201907601
Federal Aid Project No. EBHN-S014(22)
BR 3-155N&S on SR1 over Broadkill River
Sussex County

Ladies and Gentlemen:

Enclosed is Addendum No. 1 for the referenced contract consisting of the following:

1. The Bid Proposal Cover, revised, to be substituted for the same page of the Proposal.

2. Four (4) pages, Special Provision, 605504 - FRP Jacket And Epoxy Grout Pile Encasement, 18" Round Pile and 605511 - FRP Jacket And Epoxy Grout Pile Encasement, 16" Round Pile, has been revised and replaced with a three (3) page Provison.

3. Six (6) pages, Special Provision 610500 - Ultra High Performance Concrete, has been revised and replaced with a seven (7) page Provision.

4. Ten (10) pages, Special Provision 612504 - Precast Approach Slab Panels and Sleeper Slab Units, has been revised and replaced with a five (5) page Provison.

5. Five (5) pages, Special Provision 615510 -Navigation Lights for Fixed Bridges, has been revised and replaced with a twelve (12) page Provision.

6. Eleven (11) pages, Special Provision 625501 - Polyester Polymer Concrete Overlay Installation, has been revised and replaced with a ten (10) page Provision.

7. Four (4) pages, Special Provision 850532 - Temporary Lighting, has been revised and replaced with a three (3) page Provision.

Please note the revisions listed above and submit your bid based upon this information.

Sincerely,
~signature on file~
Connie Ivins
Competitively Bid Contracts Coordinator
Delaware Department of Transportation

Addendum No. 1
August 31, 2020

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION

BID PROPOSAL

CONTRACT T201907601

BR 3-155N&S ON SR1 OVER BROADKILL RIVER

Federal Aid No. EBHN-S014(22)
CFDA: 20.205

Advertisement Date: August 6, 2020

INCLUDED IN THIS DOCUMENT:

BID PROPOSAL:
GENERAL DESCRIPTION
PROSPECTIVE BIDDERS NOTES
GENERAL NOTICES
PREVAILING WAGES
SPECIAL PROVISIONS
STATEMENTS
QUANTITY SHEET SUMMARY

ADDITIONAL BID PROPOSAL ITEMS:

ATTACHED OR POSTED DOCUMENTS:
PROJECT PLANS
QUESTIONS & ANSWERS (if posted)
GUARDRAIL END-TREATMENT INFO
OJT GUIDELINES

PAPER BIDDERS CONTACT DELDOT FOR BID SUBMITTAL DOCUMENTS:
DRUG TESTING AFFIDAVIT
CERTIFICATION FORM
BID BOND FORM
CD FOR BID PRICE ENTRY & PRINTING

This Bid Proposal and related documents can be viewed on bids.delaware.gov and bidx.com/de/

Internet Bids for Bidders with Bid Express® accounts can be submitted at BIDX.com/de; **OR**;

Paper Bids with CD will be received in the Bidder's Room at the DelDOT Administration Building, Dover, DE;

ALL BIDS DUE PRIOR TO 2:00 P.M. Local Time, September 15, 2020

605504 - FRP JACKET AND EPOXY GROUT PILE ENCASEMENT, 18" ROUND PILE

605511 - FRP JACKET AND EPOXY GROUT PILE ENCASEMENT, 16" ROUND PILE

Description:

This work consists of furnishing all materials and constructing a protective pile encasement. The encasement shall consist of a fiber reinforced plastic (FRP) outer jacket with the space between the jacket and pile filled with a pourable epoxy grout.

NOTE:

If piles to be encased were coated with coal tar epoxy when originally installed, cleaning the piles will require special attention as noted under Construction Methods.

Materials:

1. Jackets - The FRP jackets shall have interlocking joints. The jackets shall be fabricated from fiberglass and polyester resins and shall be a minimum thickness of 1/8 inch, unless otherwise shown on the Plans. The inside face of the jacket shall be textured similar to a sandblasted surface and the surface shall have no bond-inhibiting agents that will come into contact with the epoxy grout. The jackets shall be provided with non-corrosive standoffs, which will maintain the jackets in the required positions (away from the face of the pile) to provide the specified void. The jacket shall be capable of being opened, placed around a pile and then returned to its original shape without damaging the jacket. Compressible sealing strips shall be installed at the bottoms of the jackets to seal the annular space between the pile and the jacket.

   The jacket shall meet the following physical-characteristics:

   (a) Water Absorption (ASTM D570) . . . . . 1% Max.

   (b) Ultimate Tensile Strength (ASTM D638)

   Longitudinal, transverse and diagonal . .15,000 psi Min.

   (c) Flexural Strength (ASTM D796) . . . . . 25,000 psi Min.

   (d) Flexural Modulus of Elasticity

   (ASTM D7790) . . . . . 700,000 psi Min.

(e) Barcol Hardness (ASTM D2583) . . . . . 45 ± 5

(f) Color . . . . . Grey or Brown as

*noted in the Plans

2. Pourable Epoxy Grout - The epoxy grout shall be a 100% solids pourable epoxy grout. The epoxy grout shall consist of an epoxy binder and epoxy extender as follows:

Binder - The binder shall be a two (2) component 2:1 ratio 100% solids pourable epoxy material. It shall be moisture insensitive for application both above and below water and it shall adhere to wet wood, steel, concrete and the FRP jacket.

Epoxy Extender - The filler shall be an epoxy extender compatible with and supplied by the manufacturer of the epoxy.

Mixing - The binder shall be mechanically mixed in strict accordance with manufacturer's instructions. One 3 gallon unit of the mixed binder shall be combined with the designated volume of epoxy extender to achieve the following consistencies:

Pourable. .(3) gallons (11.36 liters) epoxy plus (3) - 48# bags epoxy extender

Mortar Strength - When mixed on a ratio of one part binder to one part epoxy extender, 2 inch cubes of this material at seven (7) days [curing at 66?F to 74?F] shall be 8,000 psi when tested according to ASTM C 109 Modified.

3. Trowelable Epoxy Mortar - The trowel grade epoxy shall be composed of 100% solids trowel grade epoxy binder and epoxy extender as follows:

Binder - The binder shall be a two (2) component 2:1 ratio trowel grade epoxy material. It shall be moisture insensitive for application both above and below water. It shall adhere to wet concrete, steel and the FRP jacket.

Epoxy Extender - The epoxy extender shall be an epoxy extender compatible with and supplied by the manufacturer of the epoxy.

Mixing - The binder shall be machine mixed in strict accordance with manufacturer's instructions. One part of binder shall be combined with a maximum of one part of epoxy extender.

Mortar Strength - When mixed on a ratio of one part binder to one part filler, 2 inch cubes of this material at seven (7) days [curing at 60?F to 74?F] shall be 8,000 psi when tested according to ASTM C 109 Modified.

All materials shall be compatible and shall be supplied from a single source.

Construction Methods:

Shop drawings, showing location of stand-off spacers, method of fastening jacket form to piling, sealing the jacket after installation and bracing during placement of materials in the annular space between the jacket and the pile, shall be prepared by the Contractor and submitted for approval prior to any field installations.

The surface of the piles shall be cleaned to remove all marine growth, loose rust, scale and old loose coating. Existing tight coating does not require removing. Any sharp edges or metal burrs must be removed. If present, coal tar epoxy coating is classified as a hazardous waste under the USEPA Comprehensive Environmental Response, Compensation and Liability Act.

The Contractor shall submit, for approval, a method for cleaning the piles (as per manufacturer's recommendations) and for the collection and proper disposal of all material removed. If coal tar epoxy is present, include in the submitted method the disposal facility to be used. Cleaning the piles may be done under wet or dry conditions. If under wet conditions, the area must be contained to collect all removed materials. Under dry conditions, all removed materials shall be collected prior to entering the stream or soil.

Disposal of all coal tar epoxy waste shall be in accordance with Federal, state and local regulations including but not limited to:

DRGHW	**Delaware Regulations Governing Hazardous Waste**
40 CFR Part 261	Identification and Listing of Hazardous Waste
40 CFR Part 262	Standards Applicable to Generators of Hazardous Waste
40 CFR Part 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
29 CFR Part 1910	Occupational Safety and Health Regulations
20 CFR Part 1926	Safety and Health regulations for Construction

To dispose of hazardous waste, the Contractor shall obtain a hazardous waste generator identification number from DNREC Hazardous Waste Management Branch. When disposing of hazardous waste, the Contractor is responsible for preparing all notification and shipping/disposal manifests including, but not limited to, submittal of EPA Form 8700-12, Notification of Regulated Waste Activity to DNREC Hazardous Waste Management Branch.

The pile jacket shall be spread open by disengaging the interlocking joint. Then placed in position around the pile and fitted together and the bottom of the jacket form shall be sealed against the pile surface. Filling of the annular void between the pile and the pile jacket shall be done in accordance with the material manufacturer's instructions. External bracing materials shall be removed after completion of the work and the exterior surfaces of the jackets shall be cleaned of any filler material or other extraneous material deposited on the pile jackets. Around the top of the jacket a bevel shall be constructed with the trowel grade epoxy mortar to prevent water from ponding on the pile jacket tops.

Method of Measurement:

The quantity of FRP jacket and epoxy grout pile encasement will be field measured as the total number of linear feet of piling encased and accepted. Measurement will be made parallel to the axis of the pile from bottom of FRP jacket to top of FRP jacket.

Basis of Payment:

The quantity of FRP jacket and epoxy grout pile encasement will be paid for at the Contract unit price per linear foot. Price and payment will constitute full compensation for furnishing and placing all materials as described in this specification, for cleaning and preparing the piles, collecting and disposing of material removed during the pile cleaning process, for excavating and backfilling streamed material, and for all labor, equipment, tools and incidentals required to complete the work.

10/21/2019

605504 - FRP JACKET AND EPOXY GROUT PILE ENCASEMENT, 18" ROUND PILE
605511 – FRP JACKET AND EPOXY GROUT PILE ENCASEMENT, 16" ROUND PILE

Description:

This work consists of furnishing all materials and constructing a protective pile encasement. The encasement shall consist of a fiber reinforced plastic (FRP) outer jacket with the space between the jacket and pile filled with a pourable epoxy grout and galvanized welded wire fabric reinforcement as shown on the Plans.

NOTE:

The exposed portions of the existing steel monotube encasements are coated with coal tar epoxy. Cleaning the piles will require special attention as noted under Construction Methods.

Materials:

1. Jackets - The FRP jackets shall have interlocking joints. The jackets shall be fabricated from fiberglass and polyester resins and shall be a minimum thickness of 1/8 inch, unless otherwise shown on the Plans. The inside face of the jacket shall be textured similar to a sandblasted surface and the surface shall have no bond-inhibiting agents that will come into contact with the epoxy grout. The jackets shall be provided with non-corrosive standoffs, which will maintain the jackets in the required positions (away from the face of the pile) to provide the specified void. The jacket shall be capable of being opened, placed around a pile and then returned to its original shape without damaging the jacket. Compressible sealing strips shall be installed at the bottoms of the jackets to seal the annular space between the pile and the jacket.

   The jacket shall meet the following physical-characteristics:

   (a) Water Absorption (ASTM D570)……1% Max.

   (b) Ultimate Tensile Strength (ASTM D638)……..15,000 psi Min.

   (c) Flexural Strength (ASTM D790)…….. 25,000 psi Min.

   (d) Flexural Modulus of Elasticity
   (ASTM D790)….……700,000 psi Min.

   (e) Barcol Hardness (ASTM D2583)……45 ± 7

   (f) Color……..Gray or Translucent

2. Pourable Epoxy Grout - The epoxy grout shall be a 100% solids pourable epoxy grout with a minimum 28-day compressive strength of 5,000 psi. The epoxy grout shall consist of an epoxy binder and epoxy extender as follows:

   Binder - The binder shall be a two (2) component 2:1 ratio 100% solids moisture tolerant pourable epoxy material. It shall be moisture insensitive for application both above and below water and it shall adhere to wet wood, steel, concrete and the FRP jacket.

Epoxy Extender - The filler shall be an epoxy extender compatible with and supplied by the manufacturer of the epoxy.

Mixing - The binder shall be mechanically mixed in strict accordance with manufacturer's instructions.

3. Welded Wire Reinforcement – Provide galvanized welded wire reinforcement as specified in Section 1037 of the Standard Specifications. The reinforcement shall be galvanized in conformance with ASTM A 123.

All materials shall be compatible and shall be supplied from a single source.

Construction Methods:

Shop drawings showing location of stand-off spacers, method of fastening jacket form to piling, sealing the jacket after installation and bracing during placement of materials in the annular space between the jacket and the pile, shall be prepared by the Contractor and submitted for approval prior to any field installations.

Waterblast the surface of the piles with a nozzle pressure of 8,000 to 20,000 psi to remove all marine growth, loose rust, scale and old loose coating. Existing tight coating does not require removing. Any sharp edges, metal burrs, or steel tabs must be removed. Coal tar epoxy coating is classified as a hazardous waste under the USEPA Comprehensive Environmental Response, Compensation and Liability Act.

The Contractor shall submit, for approval, a method for cleaning the piles (as per manufacturer's recommendations) and for the collection and proper disposal of all material removed. If coal tar epoxy is present, include in the submitted method the disposal facility to be used. Cleaning the piles may be done under wet or dry conditions. If under wet conditions, the area must be contained to collect all removed materials. Under dry conditions, all removed materials shall be collected prior to entering the stream or soil.

Disposal of all coal tar epoxy waste shall be in accordance with Federal, state and local regulations including but not limited to:

DRGHW	Delaware Regulations Governing Hazardous Waste
40 CFR Part 261	Identification and Listing of Hazardous Waste
40 CFR Part 262	Standards Applicable to Generators of Hazardous Waste
40 CFR Part 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
29 CFR Part 1910	Occupational Safety and Health Regulations
20 CFR Part 1926	Safety and Health regulations for Construction

To dispose of hazardous waste, the Contractor shall obtain a hazardous waste generator identification number from DNREC Hazardous Waste Management Branch. When disposing of hazardous waste, the Contractor is responsible for preparing all notification and shipping/disposal manifests including, but not limited to, submittal of EPA Form 8700-12, Notification of Regulated Waste Activity to DNREC Hazardous Waste Management Branch.

The pile jacket shall be spread open by disengaging the interlocking joint. Then placed in position around the pile and fitted together and the bottom of the jacket form shall be sealed against the pile surface. Filling of the annular void between the pile and the pile jacket shall be done in accordance with the material manufacturer's instructions. External bracing materials shall be removed after completion of the work and the exterior surfaces of the jackets shall be cleaned of any filler material or other extraneous material deposited on the pile jackets.

Arrange for the FRP jacket manufacturer's representative to be on-site when installation of the FRP jackets commences.

If the new installed FRP pile jackets are damaged as a result of the Contractor's activities, the damaged FRP jacket shall be repaired or replaced to the satisfaction of the Engineer at no additional cost to the Department.

Method of Measurement:

The quantity of FRP jacket and epoxy grout pile encasement will be field measured as the total number of linear feet of piling encased and accepted. Measurement will be made parallel to the axis of the pile from bottom of FRP jacket to top of FRP jacket.

Basis of Payment:

The quantity of FRP jacket and epoxy grout pile encasement will be paid for at the Contract unit price per linear foot. Price and payment will constitute full compensation for furnishing and placing all materials as described in this specification and on the Plans, for cleaning and preparing the piles, collecting and disposing of material (including hazardous material) removed during the pile cleaning process, for excavating and backfilling stream material, and for all labor, equipment, tools and all incidentals required to complete the work.

03/13/2020

610500 - ULTRA HIGH-PERFORMANCE CONCRETE

Description:

This specification consists of mixing, transporting, placing, finishing, curing and grinding of Ultra High Performance Concrete (UHPC) for use in connections between precast structural elements in accordance with the details and notes in the Contract Documents and as directed by the Engineer. UHPC is a cementitious composite material composed of an optimized gradation of granular constituents, a water-to-cementitious materials ratio less than 0.25 and a high percentage of discontinuous internal fiber reinforcement.

Materials:

Commonly used materials are as follows. All materials must come from the same batch or lot.

(a) Fine Aggregate - Crushed Quartz with 100 % passing the No. 30 sieve and a maximum of 3% passing the No. 200 sieve.

(b) Cementitious Material - Section 801 - Portland Cement and Blended Hydraulic Cements.

(c) Steel Fibers - ASTM A 820, Type 1, cold drawn high-carbon steel with a minimum tensile strength of 300 ksi. Minimum steel fiber content shall be 2% of the mix's dry volume.

(d) Water - Section 803 - Water for Mixing Portland Cement.

(e) Admixtures - Only as directed by the manufactures representative.

The UHPC mixture shall meet the conditions listed in Table 1: UHPC Material Properties after 28 days, unless otherwise noted in the Contract Documents or as directed by the Engineer. Material properties listed below shall be verified by the manufacturer and submitted for approval in the Placement Plan.

Table 1: UHPC Material Properties

Description	Test Method	Acceptance Criteria
Compressive Strength *Ends of cylinders must be ground flush prior to testing. Saw cutting, capping, and use*	AASHTO T 22 (3"x6" cylinders) (150 psi/sec loading rate)	≥ 22 ksi after 28 days

of neoprene pads are not permitted.		
Shrinkage	AASHTO T 160 / ASTM C 157	≤ 800 micro-strain
Rapid Chloride Ion Penetrability or Surface Resistivity Testing	AASHTO T 277 / ASTM C 1202 or AASHTO TP 95	≤ 350 coulombs
Chloride Ion Penetrability	AASHTO T 259 (½" depth)	< 0.1183 lbs/yd^3
Scaling Resistance	ASTM C 672	Y < 3
Freeze-Thaw Resistance	AASHTO T 161 / ASTM C 666A (300 cycles)	Relative Dynamic Modulus of Elasticity > 95%
Alkali-Silica Reaction	ASTM C 1567 (Modified)	≤ 0.08% at 28 days
Slump Flow andVisual Stability	ASTM C1437 / ASTM C 1611	7 inches (Minimum) 10 inches (Maximum)No bleed water Consistent fiber distribution

At least 60 days prior to the placement of UHPC, submit a prepackaged batch of dry ingredients and admixtures sufficient for the Department to make a one cubic foot trial batch of UHPC. Any testing for alkali-silica reaction or permeability will be performed on specimens without steel reinforcement. Batch proportions shall otherwise remain the same per the prepackaged blend and water to cementitious materials ratio (w/cm).

Construction Methods:

(A) Storage: Assure proper storage of all materials including but not limited to cement, aggregate, steel reinforcement and additives, as required by the supplier's recommendation in order to protect the integrity of the materials against the loss of physical and mechanical properties.

(B) Placement Plan: Submit a Placement Plan with a detailed construction work schedule to the Engineer for review at least 10 days prior to the scheduled UHPC placement pour. The Placement Plan shall address at a minimum:

The following list is intended as a guide and may not address all of the means and methods the Contractor may elect to use. The Contractor is expected to assemble a comprehensive list of all necessary items for executing the placement of UHPC.

- Responsible personnel and hierarchy.
- Equipment – including but not limited to pumps, hoses, mixers, holding tanks, wheelbarrows, scales, meters, thermometers, floats, screeds, burlap, plastic, heaters, blankets, etc.
- Quality Control of batch proportions - including dry ingredients, steel fibers, water and admixtures.
- Quality Control of mixing time and batch times.
- Batch procedure sequence.
- Form work – including materials and removal.
- Placement procedure – including but not limited to surface preparation (comprising of exposed aggregate surface finish along precast elements and pre-wetting the precast concrete interface to a saturated-surface-dry (SSD) condition before the placement of UHPC), spreading, finishing, and curing protection. Include provisions for acceptable ambient conditions and batch temperatures and corrective measures as appropriate. Include means and methods to ensure all air is displaced by the UHPC and the void is completely filled.
- Threshold limits for ambient temperature, ambient relative humidity, batch consistency, batch temperature, batch times and related corrective actions.
- Construction joints, if needed, within the UHPC should be detailed and approved by the Engineer.
- Means and methods for water containment and clean up, for pre-wetting and for watertight integrity testing.

Arrange for a meeting between the UHPC manufacturer's representative, the Contractor's staff, and representatives from DelDOT Bridge Design, Construction, and Materials and Research to review the Contractor's Placement Plan. No UHPC pour will be permitted until the aforementioned Placement Plan has been submitted by the Contractor and approved by the Engineer.

Pumping of UHPC is not allowed.

Submit calculations and detailed drawings of the formwork, signed and sealed by a Professional Engineer registered in the State of Delaware. The design and fabrication of forms shall be consistent with the installation drawings and shall follow the recommendations of the UHPC manufacturer. Refer to Section C of the Construction Methods for additional requirements.

Construction loads applied to the bridge during UHPC placement and curing are the responsibility of the Contractor. Submit the weight and placement of concrete buggies, grinding equipment or other significant construction loads for review as part of the proposed Placement Plan.

(C) Forming, Mixing, Transporting, Placing and Curing: Design and fabricate formwork to adhere to Section 604.03.2 of the Delaware Standard Construction Specifications and the recommendations of the UHPC manufacturer. Construct forms from nonabsorbent material that are properly sealed and capable of resisting the hydrostatic pressures from UHPC in the unhardened state. Do not remove formwork until a compressive strength of 10 ksi is achieved. Internal vibration of the UHPC is not acceptable. However, rodding may be satisfactory to achieve a suitable blended connection where two successive pours meet.

All UHPC joints shall be covered by a top form with a moisture barrier. Supplemental heat can be provided to the UHPC and surrounding prefabricated elements to reduce initial set times and accelerate strength gain. The proposed method of artificial heating the precast concrete element shall be included in the installation drawings. Follow the UHPC manufacturer's recommendations for curing to attain the required strength to meet the project schedule.

Once the UHPC reaches a compressive strength of 10 ksi, the top forms of the joint may be removed to facilitate grinding of the joint to be even with the top surface of precast concrete element.

Forming, batching, placing, and curing shall be in accordance with the UHPC manufacturer's recommendations and as submitted and accepted by the Engineer.

Representatives of the UHPC manufacturer knowledgeable in supplying, mixing, transporting, placing, finishing and curing of the UHPC material must be present during mixing, transporting and placing of the UHPC. The Contractor shall arrange for two manufacturer's representatives to be on site for the duration of the UHPC construction; one representative will remain with the mixing operations and the second representative will remain with the placement operations. Do not start mixing or placing UHPC until the manufacturer's representatives are on-site. Place UHPC in accordance with the approved Placement Plan using one continuous pour unless otherwise detailed in the Contract Documents or as approved per the Placement Plan. UHPC should not freeze before attaining a compressive strength of 10 ksi.

Provide a minimum of two portable batching units for mixing of the UHPC. Mixing equipment which is not supplied by the UHPC manufacturer, must be reviewed by the UHPC manufacturer for adequacy. During batching keep the temperature of the UHPC below 90 degrees F; ice may be added to the mix as recommended by the UHPC manufacturer's representative.

The Contractor shall arrange for an on-site meeting with the UHPC manufacturer's representative one day before the start of the actual UHPC placement. The Contractor's staff and representatives from DelDOT Bridge Design, Construction, and Materials and Research, shall attend the meeting. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC.

(D) Acceptance Testing: DelDOT Materials and Research will be on site during the placement of UHPC. To schedule a representative, contact DelDOT Materials and Research a minimum of 48 hours prior to the anticipated UHPC placement. A representative from the Materials and Research section will perform a slump flow test according to ASTM C 1437 / ASTM C 1611 on each batch of UHPC. DelDOT Materials and Research will cast 3"x6" cylinders according to AASHTO T 23 at a minimum of once per day. Cylinders shall be cast in a single lift. Compressive strength testing will be performed at 1, 2, 3, 4 and 28 day cure times. Final acceptance will be based upon 4 day and 28 day strengths. Field coring of UHPC for dispute resolution will not be allowed. Additional specimens will be cast for permeability testing. A minimum of two lots will be selected at random from the permeability specimens and tested in accordance with AASHTO T 277 / ASTM C 1202 and AASHTO TP 95. In the event of a discrepancy between the two methods, results from ASTM C 1202 shall supersede. If one specimen from either lot exceeds the maximum permeability, two additional specimens will be selected and tested in accordance with AASHTO T 277 / ASTM C 1202, the average of which will replace the failed specimen result.

The Contractor is responsible for providing an adequate location to place acceptance specimens for initial curing prior to transport to the lab. Curing boxes will be equipped with supplemental heat or cooling as necessary to cure specimens in accordance with ASTM C 31. Testing performed by the DelDOT Materials and Research has been summarized in Table 2: DelDOT M&R UHPC Acceptance Testing. Performance frequencies of each test listed in Table 2, are a minimum value. Tests may be performed at more frequent intervals then described in Table 2, at the discretion of the Engineer or DelDOT Materials and Research division.

Table 2: DelDOT M&R UHPC Acceptance Testing

Description	Test Method	Acceptance Criteria	Frequency
Compressive Strength	AASHTO T 22	≥ 22 ksi after 28 days ≥ 14 ksi after 4 days (3"x6" cylinders) (150 psi/sec loading rate)	At least once per 25 CY or once per 12 hour shift
Rapid Chloride Ion Penetrability or Surface Resistivity Testing	AASHTO T 277 / ASTM C 1202 or AASHTO TP 95	≤ 350 coulombs after 28 days	1 per job (Performed prior to field placement)
Slump Flow and Visual Stability	ASTM C1437 / ASTM C 1611	7 inches (Min.) 10 inches (Max.) No bleed water Consistent fiber distribution	1 per batch

(E) Surface Preparation: An exposed aggregate finish shall be created on all surfaces of the precast concrete element in contact with UHPC to facilitate bond. The exposed aggregate finish shall have a 0.25-inch amplitude. In addition, the concrete contact areas shall be wetted to achieve a saturated surface dry (SSD) condition before UHPC placement. Keep wet and remove all surface water just prior to UHPC placement. Submit the procedures for achieving SSD condition as part of the proposed Placement Plan. The procedures may include: continuously wetted burlap in all joints for 12 hours prior to placement of UHPC; supplemental misting of concrete surfaces after burlap is removed if UHPC placement is delayed; etcetera.

(F) Surface Profile: The finished surface of the UHPC field joints shall be flush with adjacent precast elements to within a tolerance of plus $^1/_4$ inch and minus 0 inches. After curing, grind the UHPC surface smooth with adjacent concrete elements in order to match the profile of the structural elements that are being connected within the acceptable surface tolerance. Grinding of the UHPC surface can be performed when a minimum strength of 10 ksi is achieved. During grinding operations, if steel fiber pullout is observed, grinding shall be suspended and not resumed until approved by the Engineer.

If deemed as necessary by the Engineer, a watertight integrity test shall be performed on 10% of the joints after grinding has been completed. The test shall consist of continuously applying running water at an approximate rate of 300 gallons per hour along the length of the joints to be tested, for a duration of 30 minutes. The underside of the joint shall be inspected for water leakage at 30 minutes and at 1 hour. The joint shall be considered watertight if no dripping water or water droplets are visible underneath precast concrete element areas along the full length of the joint. If the results of the watertight integrity test are not satisfactory, the Engineer will determine the required corrective action.

Traffic shall not be permitted on the bridge until the UHPC has achieved a minimum compressive strength of 14 ksi or unless otherwise approved by the Engineer.

Method of Measurement:

The quantity of Ultra High Performance Concrete will be measured as the number of cubic feet of UHPC placed and accepted. The volume will be computed using the dimensions shown on the plans. The quantity of grinding will not be measured.

Basis of Payment:

The quantity of UHPC will be paid at the Contract unit price per cubic foot. Price and payment will constitute full compensation for mixing, transporting, placing, finishing, curing, testing and grinding and for furnishing all equipment, tools, labor, and incidentals required to complete the work.

Additional quantity of material used in the determination of material properties and for acceptance testing as described herein will be furnished at no additional cost to the Department. No additional payment will be made for joint surface preparation or for grinding procedures.

If the UHPC does not meet the minimal material properties as described herein, the UHPC shall be removed and replaced or remediated to the satisfaction of the Engineer at the Contractor's expense. If watertight integrity tests are required by the Engineer, such tests will be performed no additional cost to the Department. No additional payment will be made for remedial solutions to insufficient bonding of joints.

4/7/2017

610500 - ULTRA HIGH PERFORMANCE CONCRETE

Description:

This specification consists of mixing, transporting, placing, finishing, curing and grinding of Ultra High Performance Concrete (UHPC) for use in longitudinal joint closure pours between prefabricated superstructure modules, along expansion joints, and along link slabs in accordance with the details and notes in the Contract Documents and as directed by the Engineer. UHPC is a cementitious composite material composed of an optimized gradation of granular constituents, a water-to-cementitious materials ratio less than 0.25 and a high percentage of discontinuous internal fiber reinforcement.

Materials:

Commonly used materials are as follows. All materials must come from the same batch or lot.

(a) Fine Aggregate	- Crushed Quartz with 100 % passing the No. 30 sieve and a maximum of 3% passing the No. 200 sieve.
(b) Cementitious Material	- Section 801 - Portland Cement and Blended Hydraulic Cements.
(c) Steel Fibers	- ASTM A 820, Type 1, cold drawn high-carbon steel with a minimum tensile strength of 300 ksi. Minimum steel fiber content shall be 2% of the mix's dry volume.
(d) Water	- Section 803 - Water for Mixing Portland Cement.
(e) Admixtures	- Only as directed by the manufacturer's representative and after consultation with the DelDOT M&R lab.

The UHPC mixture shall meet the conditions listed in Table 1: UHPC Material Properties (see next page) after 28 days, unless otherwise noted in the Contract Documents or as directed by the Engineer. Material properties listed in Table 1 shall be verified by the manufacturer and submitted for approval in the Placement Plan.

Table 1: UHPC Material Properties		
Description	**Test Method**	**Acceptance Criteria**
Compressive Strength *Ends of cylinders must be ground flush prior to testing. Saw cutting, capping, and use of neoprene pads are not permitted.*	AASHTO T 22 (3"x6" cylinders) (150 psi/sec loading rate)	≥ 22 ksi after 28 days
Shrinkage	AASHTO T 160 / ASTM C 157	≤ 800 micro-strain
Rapid Chloride Ion Penetrability or Surface Resistivity Testing	AASHTO T 277 / ASTM C 1202 or AASHTO TP 95	≤ 350 coulombs
Chloride Ion Penetrability	AASHTO T 259 (½" depth)	< 0.1183 lbs/yd^3
Scaling Resistance	ASTM C 672	Y < 3
Freeze-Thaw Resistance	AASHTO T 161 / ASTM C 666A (300 cycles)	Relative Dynamic Modulus of Elasticity > 95%
Alkali-Silica Reaction	ASTM C 1567 (Modified)	≤ 0.08% at 28 days
Slump Flow and Visual Stability	ASTM C1437 / ASTM C 1611	7 inches (Minimum) 10 inches (Maximum)No bleed water Consistent fiber distribution

At least 60 days prior to the placement of UHPC, submit a prepackaged batch of dry ingredients and admixtures sufficient for the Department to make a one cubic foot trial batch of UHPC. Any testing for alkali-silica reaction or permeability will be performed on specimens without steel reinforcement. Batch proportions shall otherwise remain the same per the prepackaged blend and water to cementitious materials ratio (w/cm).

Construction Methods:

(A) Storage: Assure proper storage of all materials including but not limited to cement, aggregate, steel reinforcement and additives, as required by the supplier's recommendation in order to protect the integrity of the materials against the loss of physical and mechanical properties.

(B) Placement Plan: Submit a Placement Plan with a detailed construction work schedule to the Engineer for review at least 10 days prior to the scheduled UHPC placement pour. The Placement Plan shall address at a minimum:

The following list is intended as a guide and may not address all of the means and methods the Contractor may elect to use. The Contractor is expected to assemble a comprehensive list of all necessary items for executing the placement of UHPC.

- Responsible personnel and hierarchy.
- Equipment including but not limited to pumps, hoses, mixers, holding tanks, wheelbarrows, scales, meters, thermometers, floats, screeds, burlap, plastic, heaters, blankets, etc.

- Quality Control of batch proportions - including dry ingredients, steel fibers, water and admixtures.
- Quality Control of mixing time and batch times.
- Batch procedure sequence.
- Form work including materials and removal.
- Placement procedure including but not limited to surface preparation (comprising of exposed aggregate surface finish along precast elements and pre-wetting the precast concrete interface to a saturated-surface-dry (SSD) condition before the placement of UHPC), spreading, finishing, and curing protection. Include provisions for acceptable ambient conditions and batch temperatures and corrective measures as appropriate. Include means and methods to ensure all air is displaced by the UHPC and the void is completely filled. For cold weather placement, refer to subsection 610.03.A.1.b of the DelDOT Standard Specifications and consult with the manufacturer's representative for desired temperature conditions to meet the desired cure times.
- Threshold limits for ambient temperature, ambient relative humidity, batch consistency, batch temperature, batch times and related corrective actions.
- Construction joints, if needed, within the UHPC should be detailed and approved by the Engineer.
- Means and methods for water containment and clean up, for pre-wetting and for watertight integrity testing.
- Means and methods for UHPC containment and clean up. Any leakage of UHPC shall not enter the waterway.

Arrange for a meeting between the UHPC manufacturer's representative, the Contractor's staff, and representatives from DelDOT Bridge Design, Construction, and Materials and Research to review the Contractor's Placement Plan. No UHPC pour will be permitted until the aforementioned Placement Plan has been submitted by the Contractor and approved by the Engineer.

Pumping of UHPC is not allowed.

Submit calculations and detailed drawings of the formwork, signed and sealed by a Professional Engineer registered in the State of Delaware. The design and fabrication of forms shall be consistent with the installation drawings and shall follow the recommendations of the UHPC manufacturer. Refer to Section C of the Construction Methods for additional requirements.

Construction loads applied to the bridge during UHPC placement and curing are the responsibility of the Contractor. Submit the weight and placement of concrete buggies, grinding equipment or other significant construction loads for review as part of the proposed Placement Plan.

(C) Forming, Mixing, Transporting, Placing and Curing: Design and fabricate formwork to adhere to Section 604.03.2 of the Delaware Standard Construction Specifications and the recommendations of the UHPC manufacturer. Construct forms from nonabsorbent material that are properly sealed and capable of resisting the hydrostatic pressures from UHPC in the unhardened state. Do not remove formwork until a compressive strength of 10 ksi is achieved. Internal vibration of the UHPC is not acceptable. However, rodding may be satisfactory to achieve a suitable blended connection where two successive pours meet.

All UHPC joints shall be covered by a top form with a moisture barrier. Supplemental heat can be provided to the UHPC and surrounding prefabricated elements to reduce initial set times and accelerate strength gain. The proposed method of artificial heating the precast concrete element shall be included in the installation drawings. Follow the UHPC manufacturer's recommendations for curing to attain the

required strength to meet the project schedule.

Once the UHPC reaches a compressive strength of 10 ksi, the top forms of the joint may be removed to facilitate diamond grinding of the joint to be even with the top surface of precast concrete element.

Forming, batching, placing, and curing shall be in accordance with the UHPC manufacturer's recommendations and as submitted and accepted by the Engineer. Representatives of the UHPC manufacturer knowledgeable in supplying, mixing, transporting, placing, finishing and curing of the UHPC material must be present during mixing, transporting and placing of the UHPC. The Contractor shall arrange for two manufacturer's representatives to be on site for the duration of the UHPC construction; one representative will remain with the mixing operations and the second representative will remain with the placement operations. Do not start mixing or placing UHPC until the manufacturer's representatives are on-site. Place UHPC in accordance with the approved Placement Plan using one continuous pour unless otherwise detailed in the Contract Documents or as approved per the Placement Plan. Provide a minimum of two portable batching units for mixing of the UHPC. Mixing equipment which is not supplied by the UHPC manufacturer, must be reviewed by the UHPC manufacturer for adequacy.

UHPC should not freeze before attaining a compressive strength of 10 ksi. During batching keep the temperature of the UHPC below 90 degrees F; ice may be added to the mix as recommended by the UHPC manufacturer's representative. For cold weather curing, refer to subsection 610.03.A.1.b of the DelDOT Standard Specifications and consult with the manufacturer's representative for desired temperature conditions to meet the desired cure times.

The Contractor shall arrange for an on-site meeting with the UHPC manufacturer's representative one day before the start of the actual UHPC placement. The Contractor's staff and representatives from DelDOT Bridge Design, Construction, and Materials and Research, shall attend the meeting. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC.

Preparation of the deck surface for the PPC overlay shall not begin before the UHPC reaches a compressive strength of 14 ksi.

(D) Acceptance Testing: DelDOT Materials and Research will be on site during the placement of UHPC. To schedule a representative, contact DelDOT Materials and Research a minimum of 48 hours prior to the anticipated UHPC placement. A representative from the Materials and Research section will perform a slump flow test according to ASTM C 1437 / ASTM C 1611 on each batch of UHPC. DelDOT Materials and Research will cast 3"x6" cylinders according to AASHTO T 23 at a minimum of once per day. Cylinders shall be cast in a single lift. Compressive strength testing will be performed at 1, 2, 3, 4 and 28 day cure times. Final acceptance will be based upon 4 day and 28 day strengths or as requested by the Contractor and approved by the Department. Field coring of UHPC for dispute resolution will not be allowed.

Additional specimens will be cast for permeability testing. A minimum of two lots will be selected at random from the permeability specimens and tested in accordance with AASHTO T 277 / ASTM C 1202 and AASHTO TP 95. In the event of a discrepancy between the two methods, results from ASTM C 1202 shall supersede. If one specimen from either lot exceeds the maximum permeability, two additional specimens will be selected and tested in accordance with AASHTO T 277 / ASTM C 1202, the average of which will replace the failed specimen result.

The Contractor is responsible for providing an adequate location to place acceptance specimens for initial

curing prior to transport to the lab. Curing boxes will be equipped with supplemental heat or cooling as necessary to cure specimens in accordance with ASTM C 31. Testing performed by the DelDOT Materials and Research has been summarized in Table 2: DelDOT M&R UHPC Acceptance Testing. Performance frequencies of each test listed in Table 2, are a minimum value. Tests may be performed at more frequent intervals then described in Table 2, at the discretion of the Engineer or DelDOT Materials and Research division.

Table 2: DelDOT M&R UHPC Acceptance Testing

Description	Test Method	Acceptance Criteria	Frequency
Compressive Strength	AASHTO T 22	≥ 22 ksi after 28 days ≥ 14 ksi after 4 days (3”x6” cylinders) (150 psi/sec loading rate)	At least once per 25 CY or once per 12 hour shift
Rapid Chloride Ion Penetrability or Surface Resistivity Testing	AASHTO T 277 / ASTM C 1202 or AASHTO TP 95	≤ 350 coulombs after 28 days	1 per bridge (Performed prior to field placement)
Slump Flow and Visual Stability	ASTM C1437 / ASTM C 1611	7 inches (Min.) 10 inches (Max.) No bleed water Consistent fiber distribution	1 per batch

(E) Surface Preparation: An exposed aggregate finish shall be created on all surfaces of the precast concrete element in contact with UHPC to facilitate bond. The exposed aggregate finish shall have a 0.25-inch amplitude. In addition, the concrete contact areas shall be wetted to achieve a saturated surface dry (SSD) condition before UHPC placement. Keep wet and remove all surface water just prior to UHPC placement. Submit the procedures for achieving SSD condition as part of the proposed Placement Plan. The procedures may include: continuously wetted burlap in all joints for 12 hours prior to placement of UHPC; supplemental misting of concrete surfaces after burlap is removed if UHPC placement is delayed; etcetera.

(F) Surface Profile: The finished surface of the UHPC field joints shall be flush with adjacent precast elements to within a tolerance of plus $^1/_4$ inch and minus 0 inches. After curing, diamond grind the UHPC surface smooth with adjacent concrete elements in order to match the profile of the structural elements that are being connected within the acceptable surface tolerance. Diamond grinding of the UHPC surface can be performed when a minimum strength of 10 ksi is achieved. During grinding operations, if steel fiber pullout is observed, grinding shall be suspended and not resumed until approved by the Engineer. If deemed as necessary by the Engineer, a watertight integrity test shall be performed on 10% of the joints after diamond grinding has been completed. The test shall consist of continuously applying running water at an approximate rate of 300 gallons per hour along the length of the joints to be tested, for a duration of 30 minutes. The underside of the joint shall be inspected for water leakage at 30 minutes and at 1 hour. The joint shall be considered watertight if no dripping water or water droplets are visible underneath precast concrete element areas along the full length of the joint. If the results of the watertight integrity test are not satisfactory, the Engineer will determine the required corrective action.

Traffic shall not be permitted on the bridge until the UHPC has achieved a minimum compressive strength of 14 ksi or unless otherwise approved by the Engineer.

Method of Measurement:

The quantity of UHPC will be measured as the number of cubic feet of UHPC placed and accepted. The volume will be computed using the dimensions shown on the Plans.

Basis of Payment:

The quantity of UHPC will be paid at the Contract unit price per cubic foot. Price and payment will constitute full compensation for mixing, transporting, placing, finishing, curing, provisions for cold weather placement and curing, and testing and for furnishing all equipment, tools, labor, and incidentals required to complete the work.

Payment for diamond grinding of the UHPC will be incidental to other pertinent items in the Contract.

Additional quantity of material used in the determination of material properties and for acceptance testing as described herein will be furnished at no additional cost to the Department. No additional payment will be made for joint surface preparation or for grinding procedures.

If the UHPC does not meet the minimal material properties as described herein, the UHPC shall be removed and replaced or remediated to the satisfaction of the Engineer at the Contractor's expense. If watertight integrity tests are required by the Engineer, such tests will be performed at no additional cost to the Department. No additional payment will be made for remedial solutions to address insufficient bonding of joints.

03/13/2020

Addendum No. 1
August 31, 2020

612504 - PRECAST APPROACH SLAB PANELS AND SLEEPER SLAB UNITS

Description:

This work consists of furnishing, erecting, and installing full-depth precast concrete approach slab panels and precast sleeper slab units including all necessary materials and equipment to complete the work as shown on the Plans and as directed by the Engineer for Contract T201707403. The use of site cast-in-place concrete for approach slab panels and/or sleeper slab units will be considered as an acceptable alternative subject to receipt of written authorization from the Engineer.

Submittals:

Submit the following to the Engineer for written approval or acceptance.

A. Shop Drawings

Prepare shop drawings for each panel and unit sealed by a Professional Engineer registered in the State of Delaware. Design, detail, and locate all lifting inserts, loops or other lifting devices. Design lifting hardware according to the provisions of Chapter 5 of the PCI Design Handbook. Provide a Certificate of Compliance for non-shrink grout (refer to Materials subsection below). Provide sample of calculations for determining haunch depths for setting support angles. Calculations shall show that principal tensile stresses on both surface, especially along underside shear troughs do not exceed the modulus of rupture during the fabrication, stripping, handling, shipping, and erection of the panel or unit. Calculations shall conform to Chapter 5 of the PCI Design Handbook requirements. Do not order materials or begin work until receiving final approval of the shop detail drawings.

B. Erection Plans

The Contractor shall prepare erection drawings and supporting calculations sealed by a Professional Engineer registered in the State of Delaware and shall include the following at a minimum on the erection plans:

1. Minimum clearances of exposed reinforcing to adjacent panel and unit edges.
2. Locations and details of lifting devices.

3. Type and amount of any additional reinforcing, if required.

4. Minimum compressive strength attained prior to handling the panels or units.

5. Table showing predicted stresses and loadings encountered during all stages of panel and unit life up to installation.

6. Cables and lifting equipment needed.

7. Crane positions, pick locations, and crane charts

8. Material laydown areas

9. Details for any subgrade improvements required underneath the proposed locations of the sleeper slab units and equipment used to achieve the required grade and compaction requirements

10. Detailed procedures for lifting, moving, lowering, and adjusting panels and units into place.

11. Approach slab panel and sleeper slab unit number designation and sequence of erection.

C. Ultra-High-Performance Concrete (UHPC) Closure Pours

The Contractor shall submit to the Engineer for review the proposed method and equipment for forming the closure pours and placing UHPC for making all panel-to-panel connections plans.

Materials:

A. Concrete

Use Class D Portland Cement Concrete (PCC) for precast concrete approach slab panels and precast concrete sleeper slab units as specified in Section 1022 of the Standard Specifications except that the minimum 28-day compressive strength shall be 5000 psi. Use . inch maximum size aggregate. Place nonferrous reinforcement fibers.

B. Reinforcing Steel

Reinforcing steel shall meet AASHTO M31 Grade 60. Bars shall be epoxy-coated in conformance with ASTM A775. Reinforcement within a panel or unit shall be full-length, single bars. Do not use lap splices within a panel or unit. Fabrication and handling of bars shall conform to ASTM D3963.

C. Vent Tubes

Use 2□h PVC pipe for UHPC grout ports and vents.

D. Lifting Devices

Lifting devices shall safely support the required vertical and horizontal forces with the applicable safety factors as specified in the PCI Design Handbook, Chapter 5. Lifting devices shall have 2. inches top cover and 1 inch bottom cover after installation. This may require partial removal of the device after installation. The lifting device shall be galvanized after fabrication in conformance with AASHTO M111.

E. Non-shrink Grout

Use non-shrink grout for patching concrete after removing all lifting devices. Non-shrink grout shall meet ASTM C1107 grade C

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F. Grout Dams

Grout dams shall be foam strips fabricated from rigid high-density extruded polystyrene (XPS) conforming to ASTM C578 Type VII or approved equal. Grout dams shall be sized appropriately to prevent leakage during all under-panel grouting.

G. Grout

Grout for grout-supported bedding material may be proportioned under ASTM C938 or use prepackaged grout complying with ASTM C1107. Fine aggregate if used must meet grading two (2) in ASTM C637. Proportion the ingredients of the grout to meet the properties in Table 1.

TABLE 1 Cementitious Bedding Material Properties		
Quality Characteristic	**Test method**	**Requirement**
Compressive Strength at 1 hour	ASTM C942	500 PSI Min.
Compressive Strength at 7 days	ASTM C942	2,500 PSI Min.
Expansion	ASTM C940	0 to 3.0%
Bleeding at 30 minutes	ASTM C940	0.10% Max.
Eflux Time	ASTM C939	15 to 30 seconds
Shrinkage at 28 days	ASTM C157	< 0.04% dry
Flowability	ASTM C939	≤ 30 seconds - ½" flow cone

Grout for encasement and fill material shall meet the requirements shown in Table 2.

TABLE 2 ENCASEMENT AND GROUT FILL MATERIAL REQUIREMENTS FOR MORTARS		
Property	**Test Method**	**Requirement**
Compressive Strength, 28-day min.	ASTM C109	5,000 psi min
Compressive Strength, open to traffic	ASTM C109	2,500 psi
Maximum Expansion	ASTM C1090	0.40%
Maximum Shrinkage	ASTM C1090	0.050%
Freeze-Thaw, min.	ASTM C666	95.0% @ 300 cycles
Initial Set Time, min.	ASTM C266	15 min.

Chloride Content, max.	ASTM C1152	0.050%
Sulfate Content, max.	ASTM C1038	0.01%

Grout will be tested for compressive strength by the Department at intervals determined by the Engineer.

H. Granular Bedding for Grade-Support of Sleeper Slab Units

Bedding material for grade-support of the precast sleeper slab units shall be crushed stone meeting the gradation shown in Table 3 below. The material shall be free of deleterious material and shall be supplied at the optimum moisture to facilitate compaction and consolidation.

Table 3 Granular Bedding Course Gradation	
Sieve Size	Percent Passing
3/8 inch	100%
#4	85-100%
#10	55 - 75%
#40	10 - 40%
#200	0 - 10%

Quality Control and Assurance.

Precast deck panels shall be manufactured in a PCI Certified plant facility capable of producing Category B2 or higher bridge products. Quality Control (QC) is the responsibility of the Contractor. The person in charge of the QC Department shall have completed Level II or Level III segments of the PCI Plant Quality Personnel Certification Program (PQPC) unless otherwise agreed to by the Engineer. All technicians performing concrete testing shall hold a current ACI Concrete Field Testing Technician Certification Grade I, or equivalent, or work under the direct supervision of an ACI certified technician.

Quality Assurance (QA) is the prerogative of the Department. The role of the QA Inspector includes but is not limited to:

1. Witnessing, documenting, and reporting on the performance of the QC Department
2. Collecting all certifications, calibrations, and reports necessary to assure that the product meets the specified requirements
3. Witnessing the testing of all freshly mixed concrete
4. Witnessing the placement of all concrete
5. Witnessing the testing of process control cylinders for release and design strength
6. Determining the acceptability of the finished product

The Contractor shall give adequate notice to the Department prior to beginning any of the above operations. The presence of the QA Inspector does not relieve the Contractor of the responsibility of meeting all the requirements of the Plans and Specifications herein.

Permanently mark each precast approach slab panel and sleeper slab unit with date of casting and Manufacturer's identification. Stamp markings in fresh concrete.

Prevent cracking or damage during handling and storage of the precast panels or units. Panels or units that sustain damage or surface defects during fabrication, handling, storage, transporting, or erection are subject to review and rejection.

Any of the following conditions shall be cause for rejection of precast panels:

1. Any cracks transverse or diagonal to the reinforcement pattern and crossing more than one reinforcing bar with crack widths greater than 0.15 mm.
2. Any crack parallel to a reinforcing bar and longer than 1/3 of the panel length with crack widths greater than 0.15 mm.
3. Cracks shorter than 1/3 of the panel length and occurring at more than 25% of the total number of bars in the panel.
4. Voids or honeycombed areas with exposed reinforcing bars.

All proposed repair procedures shall be in writing. Approval shall be obtained from the Engineer before performing any repairs. Repair work must reestablish the panel fs/unit fs structural integrity, durability, and aesthetics to the satisfaction of the Engineer. Failure to take corrective action to eliminate repetitive damage is cause for rejection of the additional damaged panels or units whether repaired or not. Cracks that extend to the nearest reinforcement plane and fine surface cracks that do not extend to the nearest reinforcement plane but are numerous or extensive are subject to review and rejection. Full depth cracking and breakage greater than 12 inches in length are cause for rejection.

Precast approach slab panel and sleeper slab unit dimensional tolerances shall comply with Table 4 - Dimensional Tolerances for Precast Panels/Units:

Table 4 **Dimensional Tolerances for Precast Panels/Units**	
Panel Dimensions: Length & Width	± 1/4"
Panel Dimensions: Nominal Thickness	± 1/8”
Panel Dimensions: Squareness (diagonal difference @ top of panel)	± 3/16"
Horizontal Alignment	± 1/4"
Deviation from straightness of mating edge of panels Vertical Alignment - Camber, Horizontal Skew, and Vertical Batter	± 1/8"
Position of lifting anchors (horizontal location)	± 6.0"
Position of reinforcement (horizontal & vertical)	± 1/2"
Position of dowel bar inserts (horizontal & vertical)	± 1/4"
Dimensions of block outs & UHPC joint pockets	± 1/4"

Construction Methods:

A. Field Verification

The Contractor shall verify dimensions shown on the Plans by field measurements. All necessary field information required for the fabrication and the installation of precast approach slab panels and sleeper slab units shall be obtained before any preparation of the shop drawings or the erection plans. Any significant variation from the Plans shall be reported to the Engineer.

B. Fabrication

Do not place concrete in the forms until the Engineer has inspected and approved the placement of all materials in the precast approach slab panels and sleeper slab units. The top surface of the as-installed precast approach slab panels and sleeper slab units shall have a smooth, flat float finish. The surface of the precast approach slab panels shall later be blast cleaned after installation prior to placing the UHPC overlay and final diamond grinding. Place reinforcing steel in the approach slab panels so that only non-contact lap splices will result between individual panels. Wet cure the approach slab panels and sleeper slab units for 14 consecutive days. This cure is to begin immediately after performing the final finish. Wet cure the approach slab panels and sleeper slab units by covering all exposed surfaces with wet burlap, cotton mats, or both, and plastic sheets. Maintain a saturated condition for the burlap and cotton for the entire duration of the 14 days }7 days. Do not strip the forms before the approach slab panels and sleeper slab units have obtained a minimum compressive strength of 1000 psi. All concrete surfaces which are intended to bond with the UHPC shall have an exposed aggregate finish. The surface may be created by applying a gelatinous retarder to the formwork followed by removal (washing) of un-hydrated paste from the hardened concrete after removal of the formwork.

C. Placing Precast Approach Slab Panels and Sleeper Slab Units

The Contractor shall place the precast panels and units as shown in his approved erection plan. Comply with the precast approach slab panel and sleeper slab placement tolerances in Table 5 unless noted otherwise in the Contract Documents or accepted pre-installation Submittals.

Table 5 Precast Approach Slab Panels and Sleeper Slab Units Placement Tolerances	
Horizontal Alignment: Longitudinal centerline to surveyed centerline marked on the surface of the base and adjacent panels.	½" maximum
Transverse centerline to surveyed marks on adjacent panels	½" maximum
Vertical alignment: Top surface of precast panel with respect to top surface of adjacent panels at any point	1/4" maximum
Gap width at top surface between adjoining panels Note: Maintaining variable longitudinal joint width in excess of 1/2 inch will be cause for stoppage of panel installation operations until the Contractor states in writing how he plans to correct this deficiency.	½" maximum transverse ½" maximum longitudinal

D. Preparation and Installation of UHPC Joints

Refer to the special provisions for Item 610500 . Ultra-High-Performance Concrete for additional information related to work under this subsection. The Contractor shall visually inspect the shear lugs and reinforcing steel for proper clearances prior to placing UHPC joint material. Immediately before placing the UHPC joint material, the precast approach slab panel surfaces to be bonded shall be wetted to obtain a saturated surface dry (SSD) condition. The bonded surfaces shall be kept free from laitance, dirt, dust, paint, grease, oil, rust, or any contaminant other than water. Conduct a pre-test of the UHPC material prior to field installation using mock-ups of the joints to determine flowability, sealing and whether or not subsequent cracking will occur. Include mock-ups to match the same configuration as the joint details shown on the Plans. The pre-test shall include a water-tightness test to assess the UHPC-to-concrete bond performance. If results are unsatisfactory in the opinion of the Department, the Engineer will determine the required corrective action. The mockup will be included in the cost for Item 610500 . Ultra-High-Performance Concrete. The onsite manufacturer's representative shall advise the Contractor on how to reduce the heat of hydration such as wet curing or adding retarding admixture if the heat is excessive.

E. Placement of Bedding Grout and Encasement Grout: The Contractor shall place all grout as shown in the approved installation plan.

The Contractor shall verify that in-place panels that have been subjected to traffic loading are at correct grade and in compliance with the panel placement tolerances in Table 5 prior to grout placement.

Placement of dowel bar grout shall be completed within 48-hours of initial panel placement. If adverse weather delays grouting operations, complete as soon as weather permits. Place bedding grout after dowel bar grout and in the same work shift. Construction traffic shall be kept off of panels after grouting and prior to opening to traffic.

F. Diamond Grinding

Grind the top of the precast approach slab panels to correct any uneven surfaces across the panel joints. Profile grind up to . inch maximum only after all panels are in place, grouting completed, and UHPC design strength has been achieved. Diamond grind the top of the completed approach slab panels to achieve the required finish.

Method of Measurement:

The quantity of Precast Concrete Approach Slab Panels and Precast Sleeper Slab Units will be measured using Plan quantities.

Basis of Payment:

The payment for Precast Concrete Approach Slab Panels and Precast Sleeper Slab Units will be at the Contract unit price bid per cubic yard. Price and payment will constitute full compensation for fabricating, transporting and placing of the approach slab panels and sleeper slab units; survey; forming, curing and testing of UHPC joints; mechanical grooving; and for furnishing all equipment, tools, labor, and incidentals required to complete the work.

Additional quantities of material used for the determination of material properties or for acceptance testing as described herein will be furnished at no additional cost to the Department.

Quantities of reinforcing steel incorporated into the precast concrete approach slab panels and precast sleeper slab units and extending into panel joints will be incidental to this item. Furnishing and placing UHPC joint material will be paid for under Item 610500 . Ultra-High Performance Concrete. Placement of the UHPC Overlay on precast approach slabs will be paid for under Item 6255XX . Ultra-High Performance Concrete Overlay. Diamond grinding of the entire completed approach slab to the required finish, will be measured and paid for according to Item 501502 - Diamond Grinding for P.C.C. Pavement and Precast Pavement.

612504 - PRECAST APPROACH SLAB PANELS AND SLEEPER SLAB UNITS

Description:

This work consists of fabricating, furnishing, erecting, and installing full-depth precast concrete approach slab panels and precast sleeper slab units, both consisting of integral precast parapets, including all necessary materials and equipment to complete the work as shown on the Plans and as directed by the Engineer. The Contractor has the option of providing all precast approach slab panels, all precast sleeper slab units, and/or substituting cast-in-place concrete for the precast elements at no additional expense to the Department.

Submittals:

Submit the following to the Engineer for written approval or acceptance.

A. Shop Drawings

Prepare shop drawings for each precast unit sealed by a Professional Engineer registered in the State of Delaware. Design, detail, and locate all reinforcing steel bars, lifting inserts, loops, or other lifting devices. Design lifting hardware according to the provisions of Chapter 5 of the PCI Design Handbook. Provide a Certificate of Compliance for non-shrink grout (refer to Materials subsection below). Calculations shall conform to Chapter 5 of the PCI Design Handbook requirements. Provide all reinforcing steel bar bends and bar lengths for each precast unit in a reinforcement schedule. Use CRSI or ACI tables as applicable. Where bars are to be bent more accurately than standard bending tolerances, bending dimensions requiring closer fabrication should have limits indicated on the shop drawings. Do not order materials or begin work until receiving final approval of the shop detail drawings.

If the Contractor chooses to provide a different method of providing the approach slabs and sleeper slabs than shown on the Plans, the Contractor shall submit a layout of these units and include details and calculations. These details shall include any details for subgrade improvements underneath the proposed locations of the alternative precast sleeper slab units and equipment used to achieve the required grade and compaction requirements. Class D concrete shall be used for cast-in-place sleeper slab and/or approach slab alternative and Class A concrete shall be used for cast-in-place parapet alternatives. If ultra high performance concrete (UHPC) joint closure pours are utilized, the proposed method and equipment for forming the closure pours and placing the UHPC for making any panel-to-panel connections shall be submitted to the Engineer. Reference the Special Provisions for Item 610500 – Ultra High Performance Concrete for more information.

B. Erection Plans

The Contractor shall prepare erection drawings and supporting calculations sealed by a Professional Engineer registered in the State of Delaware and shall include the following at a minimum on the erection plans:

1. Locations and details of lifting devices.
2. Type and amount of any additional reinforcing, if required. Provide all reinforcing steel bar bends and bar lengths for added reinforcement in a reinforcement schedule. See Section A. above.

3. Minimum compressive strength attained prior to handling the precast units.
4. Table showing predicted stresses and loadings encountered during all stages of panel and unit life up to installation.
5. Cables and lifting equipment needed.
6. Crane positions, pick locations, and crane charts.
7. Material laydown areas.
9. Details for any vertical adjustment of the approach and / or sleeper slabs to achieve finished roadway elevations.
10. Detailed procedures for lifting, moving, lowering, and adjusting panels and units into place.
11. Approach slab panel and sleeper slab unit number designation and sequence of erection.

Materials:

A. Concrete

Use Class D Portland Cement Concrete (PCC) for precast concrete approach slab panels and precast concrete sleeper slab units as specified in Section 1022 of the Standard Specifications except that the minimum 28-day compressive strength shall be 5000 psi. Use 1 inch maximum size aggregate. Place nonferrous reinforcement fibers.

B. Reinforcing Steel

Reinforcing steel shall meet AASHTO M31 Grade 60. Bars shall be epoxy coated in conformance with ASTM A775. Reinforcement within each precast unit shall be full-length, single bars. Fabrication and handling of bars shall conform to ASTM D3963.

C. Lifting Devices

Lifting devices shall safely support the required vertical and horizontal forces with the applicable safety factors as specified in the PCI Design Handbook, Chapter 5. Lifting devices shall have 2 inches top cover and 1 inch bottom cover after installation. This may require partial removal of the device after installation. The lifting device shall be galvanized after fabrication in conformance with AASHTO M111.

D. Non-shrink Grout

Use non-shrink grout for patching concrete after removing all lifting devices. Non-shrink grout shall meet ASTM C1107 Grade C.

Quality Control and Assurance:

Precast deck panels shall be manufactured in a PCI Certified plant facility capable of producing Category B2 or higher bridge products. Quality Control (QC) is the responsibility of the Contractor. The person in charge of the QC Department shall have completed Level II or Level III segments of the PCI Plant Quality Personnel Certification Program (PQPC) unless otherwise agreed to by the Engineer. All technicians performing concrete testing shall hold a current ACI Concrete Field Testing Technician Certification Grade I, or equivalent, or work under the direct supervision of an ACI certified technician.

Quality Assurance (QA) is the prerogative of the Department. The role of the QA Inspector includes but is not limited to:

1. Witnessing, documenting, and reporting on the performance of the QC Department.
2. Collecting all certifications, calibrations, and reports necessary to assure that the product meets the specified requirements.
3. Witnessing the testing of all freshly mixed concrete.
4. Witnessing the placement of all concrete.
5. Witnessing the testing of process control cylinders for release and design strength.
6. Determining the acceptability of the finished product.

The Contractor shall give adequate notice to the Department prior to beginning any of the above operations. The presence of the QA Inspector does not relieve the Contractor of the responsibility of meeting all the requirements of the Plans and Specifications herein.

Permanently mark each precast unit with date of casting and Manufacturer's identification. Stamp markings in fresh concrete.

Prevent cracking or damage during handling and storage of the precast panels or units. Panels or units that sustain damage or surface defects during fabrication, handling, storage, transporting, or erection are subject to review and rejection.

Any of the following conditions shall be cause for rejection of precast elements:

1. Any cracks transverse or diagonal to the reinforcement pattern and crossing more than one reinforcing bar with crack widths greater than 0.15 mm.
2. Any crack parallel to a reinforcing bar and longer than 1/3 of the panel length with crack widths greater than 0.15 mm.
3. Cracks shorter than 1/3 of the panel length and occurring at more than 25% of the total number of bars in the panel.
4. Voids or honeycombed areas with exposed reinforcing bars.

All proposed repair procedures shall be in writing. Approval shall be obtained from the Engineer before performing any repairs. Repair work must reestablish the structural integrity, durability, and aesthetics to the satisfaction of the Engineer. Failure to take corrective action to eliminate repetitive damage is cause for rejection of the additional damaged panels or units whether repaired or not. Cracks that extend to the nearest reinforcement plane and fine surface cracks that do not extend to the nearest reinforcement plane but are numerous or extensive are subject to review and rejection. Full depth cracking and breakage greater than 12 inches in length are cause for rejection.

Precast approach slab panel and sleeper slab unit dimensional tolerances shall comply with Table 1 - Dimensional Tolerances for Precast Units:

Table 1 Dimensional Tolerances for Precast Units	
Unit Dimensions: Length & Width	± 1/4"
Unit Dimensions: Nominal Thickness	± 1/8"
Panel Dimensions: Squareness (diagonal difference @ top of panel)	± 3/16"
Horizontal Alignment	± 1/4"
Position of lifting anchors (horizontal location)	± 6.0"

Position of reinforcement (horizontal & vertical)	± 1/2"

Construction Methods:

A. Field Verification

The Contractor shall verify dimensions shown on the Plans by field measurements. All necessary field information required for the fabrication and the installation of precast approach slab panels and sleeper slab units shall be obtained before any preparation of the shop drawings or the erection plans. Any significant variation from the Plans shall be reported to the Engineer.

B. Fabrication

Do not place concrete in the forms until the Engineer has inspected and approved the placement of all materials in the precast units. The top surface of the as-installed precast approach slab panels shall have a broomed finish. The top surface of the as-installed precast sleeper slab units shall have a smooth, flat float finish. All concrete surfaces which are intended to bond with cast-in-place concrete shall have an exposed aggregate finish. The surface may be created by applying a gelatinous retarder to the formwork followed by removal (washing) of unhydrated paste from the hardened concrete after removal of the formwork. Wet cure the approach slab panels and sleeper slab units for 14 consecutive days. This cure is to begin immediately after performing the final finish. Wet cure the precast units by covering all exposed surfaces with wet burlap, cotton mats, or both, and plastic sheets. Maintain a saturated condition for the burlap and cotton for the entire duration of the 14 days ± 7 days. Do not strip the forms before the approach slab panels and sleeper slab units have obtained a minimum compressive strength of 1000 psi.

C. Placing Precast Approach Slab Panels and Sleeper Slab Units

The Contractor shall place the precast units as shown in the approved erection plan. The alignment tolerances of the precast elements shall be as shown in Table 2. The top surface of the precast approach slab panels shall later be blast cleaned after installation and diamond grinding and prior to placing the PPC overlay.

Table 2 **Precast Approach Slab Panels and Sleeper Slab Units Placement Tolerances**	
Horizontal Alignment: Longitudinal centerline to surveyed centerline marked on the surface of the base and adjacent panels.	½” maximum
Transverse centerline to surveyed marks on adjacent panels	½” maximum
Vertical alignment: Top surface of precast panel with respect to top surface of adjacent panels at any point	¼” maximum

Gap width at top surface between adjoining panels Note: Maintaining variable longitudinal joint width in excess of 1/2 inch will be cause for stoppage of panel installation operations until the Contractor states in writing how he plans to correct this deficiency.	½" maximum transverse ½" maximum longitudinal

D. Diamond Grinding

Grind the top of the precast approach slab panels to correct any uneven surfaces across the panel joints with adjacent cast-in-place concrete portion of the approach slab and the adjacent cast-in-place concrete deck over. Profile grind up to 1/4 inch maximum only after the panels are in place, grouting completed, and the cast-in-place portion of the approach slab and the cast-in-place deck over design strengths have been achieved.

Method of Measurement:

The quantity of Precast Concrete Approach Slab Panels and Precast Sleeper Slab Units will be measured using Plan quantities.

Basis of Payment:

The payment for Precast Concrete Approach Slab Panels and Sleeper Slab Units will be at the Contract unit price bid per cubic yard. Price and payment will constitute full compensation for fabricating, roughening, storage, furnishing, transporting, and erecting the approach slab panels and sleeper slab units; surveying; diamond grinding; and for all materials, equipment, tools, labor, and all incidentals required to complete the work.

Price and Payment for furnishing and installing conduit and other accessories for the navigational lighting system that are embedded within the precast concrete approach slabs will be paid and specified by Item 615510 - Navigation Lights System for Fixed Bridges.

Quantities of reinforcing steel incorporated into the precast concrete approach slab panels and precast sleeper slab units and extending into the cast-in-place portion of the approach slab and cast-in-place abutment deck over will be incidental to this item.

03/13/2020

Addendum No. 1
August 31, 2020

615510 - NAVIGATION LIGHTS FOR FIXED BRIDGES

Description:

Furnish and install navigation lighting systems, including all wiring, junction boxes, conduit, wiring devices, lights, attachments to the bridge structure, etc., as shown in the plans and in compliance with Code of Federal Regulations (CFR), Title 33, Part 118, which is further clarified in U.S. Coast Guard (USCG) Publication "A Guide to Bridge Lighting". Navigation lights must operate from sunset to sunrise and during periods of low visibility.

Coordination of Electrical Work. Use experienced personnel in the type of work required by the Contract Documents to provide a complete and satisfactory fitting and fully operational installation. Perform all electrical work either by, or under the immediate supervision of an electrical journeyman. Meet NEC, NESC, local utility company requirements, and State and local laws and ordinances governing the work.

Schedule and arrange electrical work in a neat, well-organized manner without interference with the work scheduling of other trades.

Catalog Cuts. Submit catalog cuts and shop drawings for approval.

Materials:

Meet the equipment and material requirements as shown in the Contract Documents.

Furnish and install only materials and equipment of new stock meeting ANSI, NEC, NEMA, and UL requirements, and approved by the Engineer, except where the Contract Documents allow or specify the use of other than new equipment.

Furnish and install marine type products manufactured of corrosion resistant materials.

Navigation Lights:

Location: The upstream and downstream sides of the channel margins shall be marked with 180 degree bridge mounted red channel margin marker lights. The lights shall be securely mounted on the bridge to show 90

degrees on either side of a line parallel to the axis of the channel so as to be visible from an approaching vessel.

The upstream and downstream sides of the center of the channel shall be marked with 360 degree bridge mounted green channel center marker lights. The lights shall be in line with the axis of the center of the channel so as to be visible from an approaching vessel.

Housing:

The housing shall be suitable for a marine environment. Furnish unpainted housings of heavy duty cast aluminum or bronze construction with a 1 1/2 to 2 inch threaded conduit opening on the bottom. Construction shall be rain tight and fully gasketed. The light assembly shall be designed for heavy duty, long life service. The design shall provide ready access for lamp service.

Lens: Furnish and install fixtures with lenses that are standard marine molded, single-piece fresnel type, rigid, heat resistant glass or U.V. resistant polycarbonate and inside diameter of 7 to 8 inch. Furnish all stainless steel closure bolts, lens tie rods, and attachment hardware for a complete and accepted installation.

Lamps:

Lamps shall be 120V AC, LED array with a minimum of 50,000 hour life and bright enough to meet the visibility requirements of CFR Title 33, Part 118. Mount LED arrays on an internal shock and vibration isolator. Ianthe event of failure of one or more individual LEDs, the remaining LEDs shall continue to operate.

Swivel:

Provide a cast aluminum or bronze swivel assembly and mounting bracket, complete with stainless steel pivot, watertight "O" ring seal, bronze bearings, cable entrance fitting, and stainless-steel service chain rated for a minimum 225 pounds load. The swivel design shall provide for all wiring to be completely contained inside the light assembly. The dimension from the center of swivel to focal plane of lens shall allow for visibility of the luminaire below the bridge girder in accordance with Coast Guard requirements.

Stem:

Use a 1 1/2- or 2-inch galvanized pipe or stainless steel pipe as a hanger stem. Furnish and install a 60% counterweight if stem exceeds 5 feet in length.

Latch:

An automatic latch shall hold the luminaire securely in normal operations and service positions. A firm pull on the service chain shall automatically release the latch, allowing the fixture to pivot. As the luminaire is raised, the latch shall automatically engage to hold the light in the service position.

Mounting:

The base shall be cast of the same material as the fixture head. The light assembly shall mounted via four inch diameter bolts through the base and junction box.

Service Chain:

A stainless steel, #24 sash type service chain shall be provided to facilitate raising and lowering the luminaire for service. The grab-loop on the chain shall be securely mounted to the bridge as shown on the plans so that it is easily accessible by maintenance personnel for service.

Junction Box:

The assembly shall be equipped with a junction box and a gasketed access cover. The junction box shall be of the same material as the fixture assembly and shall match the navigation light base footprint. Orientation of the junction box shall be capable of rotation in 90 degree increments.

Conduit:

Conduit shall be as specified elsewhere in these Contract Documents.

Junction Wells:

P.C.C. Barrier Junction Wells shall be as specified in Item 830500 -P.C.C. Barrier, Junction Well. Junction Box On Structure shall be as specified in Item 830501 - Junction Box On Structure.

Wiring:

Cable shall be as specified elsewhere in these Contract Documents.

Construction Methods:

Store navigational lights and appurtenances in a manner which will prevent damage until such time as they are actually installed. Immediately prior to installation, navigation lights and appurtenances shall be inspected for damage by the Engineer. All material which the Engineer determines is damaged or otherwise unusable shall be repaired by the Contractor or replaced in-kind by the Contractor. The Engineer shall make the final determination as to whether damaged material shall be repaired or replaced. Material which the Engineer has determined is not usable shall be removed from the work site by the contractor.

Installation:

Install conduit and barrier junction wells in the bridge parapet walls and bridge deck as shown on the plans. Route conduit and wiring to the navigational lights as shown on the plans.

Navigation lights shall be installed in the manner indicated on the contract plans and per the manufacturer's recommendations. Location and color shall be in accordance with the U.S. Coast Guard requirement and the contract plans.

Testing:

Testing of the navigation lighting system shall be in accordance with Item 843001 - Electrical Testing.

Method of Measurement:

The quantity of Navigation Lights for Fixed Bridges will be paid for will be lump sum.

Basis of Payment:

Price and payment will be full compensation for all work specified in this Section. Payment will be made under: ''Navigation Lights for Fixed Bridges" - lump sum. Conduit, cable and barrier junction wells will be paid under separate pay items as listed elsewhere in the Contract Documents.

4/18/19

615510- NAVIGATION LIGHTS FOR FIXED BRIDGES

Description:

The Work under this Section shall consist of furnishing all labor, materials, plant and equipment, and performing all work necessary to furnish, install and adjust the electrical equipment and controls for operation of Bridge Nos. 3-155N and 3-155S navigation lights as specified herein and indicated on the Contract Plans.

New navigation lights and new service metering and lighting controls shall be installed under this item and shall be provided as shown on the Contract Plans and specified herein.

New conduit wiring, junction boxes, junction wells and all other associated enclosures shall be installed under this item for the navigation lights and lighting controls as shown on the Contract Plans and specified herein. All existing conduit and wire under this item shall be removed and properly disposed of.

It is the intent and purpose of these Specifications to cover and include all apparatus and appliances to properly install, wire, connect, equip, test, adjust, and put into approved working order the respective portions of the electrical work herein specified. Any incidental apparatus, appliance, material, or labor not herein specifically mentioned or included that may be found necessary to comply with the requirements of the related documents and referenced standards or codes shall be furnished by the Contractor at no additional cost to the Department.

Materials:

All electrical equipment and its installation shall conform to the latest revision of the codes and standards specified in the Contract Plans. The Contractor shall obtain all required permits and approvals of all Departments or Agencies having jurisdiction.

Materials and workmanship shall conform to all requirements specified in the Contract Plans.

1. Conduit - Provide conduit, sweeps, end caps, condulets, conduit hangers, bushings, and all applicable appurtenances of compatible Materials meeting the requirements specified herein and on the Contract Plans.

    a. Schedule 80 PVC Conduit material requirements shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 1062.01(A).

    b. PVC-Coated Rigid Galvanized Steel Conduit shall meet the following physical characteristics:

        i. UL Listed

        ii. Hot-dipped Galvanized

        iii. Conform to the requirements of ANSI C80.1, UL-6 and UL-514B

        iv. Conform to the National Electrical Code 2017, Article 344

v. Conform to NEMA RN-1

c. Conduit Hanger material requirements shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 1062.01(F).

d. Conduit/duct Sealant material requirements shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 1062.01(G).

e. Conduit warning tape material requirements shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 1062.01(I).

f. Conduit expansion fittings shall be provided as shown in the Contract Plans. The fittings shall permit a total conduit movement of 8 inches.

g. Conduit expansion/deflection fittings shall permit a movement of 3⁄4 inch from the normal in any direction. The fitting shall be manufactured by Thomas and Betts or Engineer approved equal.

2. Grounding

a. Ground Rods shall meet the following physical characteristics:

i. UL Listed

ii. ¾ inch diameter

iii. 10 feet long (minimum unless otherwise specified)

iv. Copper-clad steel

v. Approved Clamps for connecting grounding conductor to ground rod

b. Grounding hardware material requirements shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 1039.

3. Electrical Service and Control Pedestal

a. The Pedestal Board material requirements shall be in accordance with the Contract Plans.

b. The Single Position Socket material requirements shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 1078.01(C).

c. The Control Panel shall meet the following physical characteristics:

i. Enclosure is rated NEMA 4X

ii. Enclosure has door clamps, solid neoprene gaskets, welded seams, stainless steel external hardware and continuous hinges with stainless steel pins

iii. Install breather/drain fitting at base of enclosure

iv. Equip enclosure for padlocking

v. Disconnect Switch – See Contract Plans for details

vi. Hand/Off/Auto Selector Switch – See Contract Plans for details

vii. Miniature Circuit Breakers – See Contract Plans for details

viii. Terminal Block – See Contract Plans for details

ix. Ground Bar – See Contract Plans for details

x. The Photocell shall meet the following physical characteristics:

1. Solid state

2. Cadmium sulfide type with hermetically sealed silicone rectifier rated 120V, 60 cycle AC and 1800 watts maximum load

3. Equip with built in surge protection

4. Equip with a fail-safe operating feature so that the lighting circuits will remain energized in the event the photo control components become inoperative

5. Nominal operating levels of this control shall turn on at a minimum vertical illumination value of 3 foot-candles and turn off at a maximum vertical illumination value of 6 foot-candles

a. Have the manufacturer set these limitations; and tolerances of plus or minus 20 percent for the specified value will be acceptable

6. Equip with twist lock type photoelectric controls for luminaires and lighting controls

7. Supply with a suitable mounting bracket with locking type receptacle and all other necessary mounting hardware

4. Electrical Cable and Splicing

a. Electrical Cable shall meet the following physical characteristics:

i. Electrical Cable and Wire, NEC, 600 V, UL approved

1. Stranded, single conductor copper cables (XLP insulated)

a. XHHW-2 rated as noted on the Plans.

2. Bare or Insulated stranded copper grounding wire

3. Triplex aluminum service cable

4. Type SOOW Cable with ground

    a. Electrical Cord for Navigation Lights shall be supplied with navigation lighting fixtures

    b. Electrical Cord for Navigation Lights shall be shipboard grade and designed for use in outdoor environments.

    c. Electrical Cord shall meet UL 1685 and CSA 22.2

5. Enclosures

    a. Junction Wells – Provide Type 5 junction wells and all applicable accessories and appurtenances as shown in the Contract Plans. Materials shall meet the requirements described herein.

        i. Junction wells shall be made of precast concrete, Class B as described in DelDOT Standard Specifications for Road and Bridge Construction, Section 1022

        ii. Base shall be made of Del. Stone No. 57 as described in DelDOT Standard Specifications for Road and Bridge Construction, Section 1004

        iii. Castings shall be supplied in conformance with details provided in DelDOT Standard Specifications for Road and Bridge Construction, Section 1039

        iv. Frames and Lids shall be supplied in conformance with details provided in DelDOT Standard Specifications for Road and Bridge Construction, Section 602

        v. Lids shall be provided with a logo on the cover reading, “DOT-E”

    b. Exposed Junction Boxes shall meet the following physical characteristics:

        i. NEMA 4X Rated

        ii. 316 Stainless steel construction

        iii. Enclosures shall have door clamps, solid neoprene gaskets, welded seams, stainless steel external hardware and continuous hinges with stainless steel pins

        iv. Install Engineer approved breather/drain fitting at base of all exposed junction boxes

        v. See additional details in Contract Plans

    c. Embedded Junction Boxes shall meet the following physical characteristics:

        i. NEMA 4X rated

        ii. Box covers shall be gasketed and made of the same material as the box

        iii. Junction box hardware shall be Type 316 stainless steel and tamper resistant

iv. Embedded junction boxes shall be sized as required by the National Electrical Code Article 314 and to be properly secured during casting of the parapet barrier

v. Embedded junction boxes shall be provided with a ½" diameter drain fitting and ½" polyethylene drain tube

6. Navigation Lights

a. Pier Navigation Lights shall meet the following physical characteristics:

i. Vandal Resistant

ii. Dual unit, 8-inch outside diameter, 180-degree red fresnel lens

iii. Lights shall be mounted on a short section of 1-1/2" stainless steel pipe with a cast bronze flange

iv. Each light housing shall be cast bronze and securely bolted in position with bronze or stainless steel anchors not less than 3/8 inch in diameter. Each light shall be equipped with 120 volt, 100,000-hour red LED lamps

v. Shall be type PL pier light as manufactured by B&B Roadway, LLC. or approved equal

b. Span Navigation Lights shall meet the following physical characteristics:

i. Span Navigation Light metal parts shall be made of grade 304 stainless steel

ii. All plastic parts shall be made of light stabilized polycarbonate plastic

iii. Electrical cables shall be integral to the navigation light fixture and shall be shipboard grade and designed for salt water environments and shall meet UL 1685 and CSA 22.2

iv. The light head shall be hermetically sealed and shall be able to withstand at least 5 pounds vacuum while submerged

v. Illumination shall meet or exceed U.S. Coast Guard 33 CFR Part 118 regulations for bridge navigation lights

vi. Red Span navigation lights shall have a 180 degree viewing angle. Green lights shall have a 360 degree viewing angle

vii. The rated life of LED fixtures shall be at least 50,000 hours

viii. Span navigation lights shall be Series Bridge-Tube-LT manufactured by McDermott Light and Signal or approved equal

Construction Methods:

1. Conduit - Furnish and install conduit (metallic and non-metallic) in accordance with the Contract Plans and as directed by the Engineer.

a. Construction – Construction of conduit systems shall be in accordance with Contract Plans and DelDOT Standard Specifications for Road and Bridge Construction, Section 831.03.

b. PVC Schedule 80 Conduit

Furnish PVC conduit meeting the material requirements of Materials Section 1(A) herein and as specified in the Contract Plans. Using conduit tools, cut and prepare the conduit. Connect all lengths of PVC conduit by inserting the normal end of one length of conduit into the flared end of the adjoining length of conduit. If this is not possible, then a coupling may be used. Seal all joints with appropriate epoxy to ensure that the two conduit pieces bond to one another to form a solid waterproof link. If approved by the Engineer, a coupler module may be used where conduit segments do not align properly to allow the flared end of one conduit segment to mate with the normal end of the other segment. Place sealed end caps on the ends of all conduits after compressed air has been used to clear all foreign matter.

c. PVC-Coated Rigid Galvanized Steel Conduit

Coat all boxes and fittings, which serve as part of the raceway, with the same exterior PVC coating and red interior urethane coating. Ensure the plastic exterior coating and the red interior urethane coating are factory applied by the same manufacturer who produces the hot-dip galvanized conduit. Install PVC coated conduit according to the manufacturer's installation manual. Repair all damaged PVC coating using manufacturer recommended repair procedures and materials.

Provide all conduit ends with insulated throat grounding hubs.

Ensure unions to connect sections of conduit that cannot be joined to each other or to boxes in the regular manner are of malleable iron or steel, hot-dip galvanized, PVC coated.

Provide conduit with a diameter as indicated on the Contract Plans. The interior surfaces shall have a smooth finish and be free of burrs or projections which might cause injury to the cables. Ensure all conduits are free from blisters, cracks, or injurious defects. Ream conduits at each end after being threaded. Connect sections to each other with screw couplings made up so that the ends of both conduits will butt squarely against each other inside of the coupling. Install conduits so as to be continuous and watertight between boxes or equipment. Protect conduits at all times from the entrance of water or other foreign matter by being well-plugged overnight or when the work is temporarily suspended.

Make conduit bends and offsets by cold bending using approved methods and equipment. The use of a pipe tee or vise for bending conduit will not be permitted. Discard all conduit that have been crushed or in any way deformed. Ensure all bends are long sweep, free from kinks, and of such easy curvatures as to permit the drawing of conductors without injury. Make conduit runs with as few couplings as standard lengths will permit. Ensure the total angle of all bends between any 2 boxes or cabinets does not exceed 3 quarter bends, unless otherwise approved by the Department. Ensure the radius of curvature of pipe bends is not less than 8 times the

inside diameter of said conduit. Long running threads will not be permitted. Use pull boxes whenever necessary to facilitate the installation of the wire.

d. All embedded conduit in precast concrete slabs shall be properly secured to rebar prior to casting. Conduit shall be located and oriented as to align with adjacent precast and cast-in-place sections. Ensure that conduit ends are protected and sealed from intrusion of concrete and other debris and contaminants during the casting process and during shipping and installation.

e. Unpaved Trench Installation

Unpaved trench installation shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 831.03.8.

f. Installation of Conduit on Structure

Install conduit on Structure, as specified in the Contract Plans and in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 831.03.9.

2. Grounding – Furnish and install grounding equipment in accordance with the Contract Plans and as directed by the Engineer.

a. Provide certified test reports verifying the ground resistance of each ground or ground grid when installed.

b. Ground Rods

i. Installation of ground rods shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 833.03.1

c. Bonding & Grounding Junction Well

i. Bonding and grounding of junction wells shall be in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 833.03.2

d. Bonding & Grounding Junction Boxes

i. Exposed and embedded junction boxes shall be ground bonded to the equipment grounding system using the manufacturer recommended method

3. Electrical Service and Control Pedestal – Furnish, install, and remove lighting service pedestal and safety switch in accordance with the Contract Documents and as directed by the Engineer.

a. General

i. Perform all work in compliance with NEC, NFPA, and NESC Standards and with utility company minimum requirements

ii. Install Electric Service Pedestal as shown in the Contract Plans

iii. Locate Electrical Service and Control Pedestal as shown on Contract Plans

iv. Mark Electrical Service and Control Pedestal with weatherproof stamp

1. Label switch "Lighting", denoting the device it serves

v. Tighten all conduits and hardware connections with the appropriate wrenches or tools

b. Electrical Service and Control Pedestal

i. Excavate area for pedestal

ii. Install conduit

1. Use a conduit adapter to connect sweeps to underground conduit and conduit leading to the safety switch and meter

2. Install an appropriate length of 1-1/2 inch PVC coated rigid galvanized conduit (threaded and reamed on both ends) on the end of the 90 degree sweeps at the base of the pedestal board so that the end of the conduit will be approximately 3 feet above the finished grade of the area

a. Install square tube steel posts per Standard Construction Details in 12 inch X 12 inch X 36 inch concrete footings

3. Provide 3 inch clearance on the base of footing

iii. Backfill around the conduit and concrete footings and dispose of excess or unsuitable materials to grade of the bottom of concrete footings

1. Backfill may be placed after the first 24 hours. Backfill in accordance with Section 202 of DelDOT Standard Specifications for Road and Bridge Construction

2. Remove all excess material. Suitable Material may be used elsewhere on the Project as directed by the Engineer

iv. Set square tube steel posts

1. Determine the finished length of the tubular steel posts by adding the total height of the meter and safety switch to 5 feet

v. Install ground rod in accordance with the Contract Plans and Construction Methods Section 2(B) herein

vi. Attach pedestal board to square tube steel posts using stainless steel hex bolts and washers

vii. Arrange inspection by a Delaware licensed electrical inspection agency for all lighting system Work including but not limited to service, branch circuits, junction wells, underground conduit, all grounding and bonding and any electrical work performed on the Project

1. Submit certification for the Delaware licensed electrical inspection agency to the Engineer for approval prior to starting Work

viii. Remove electric service from wood or metal pole as directed by the Engineer

4. Electric Cable and Splicing - Furnish and install electrical cable and splices in accordance with Contract Plans and as noted herein.

a. General

i. Transport and unreel electric cable from a cable trailer

1. Do not lay reels on the ground to remove wire or cable

ii. Avoid damaging cable insulation when removing cable from drums or reels, or during installation of the cable

iii. Remove and replace all unacceptable cable with new cable using the specified methods at no cost to the Department

b. Pulling cable or wire through conduit

i. Pulling of cable/wire through conduit shall be conducted in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 832.03(B)

c. Splicing -

i. Single Conductor Stranded Wire

1. Splicing of conductors shall be performed in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 832.03(D)

ii. Taps or Tee Splices

1. Taps and Tee Splices shall be performed in accordance with DelDOT Standard Specifications for Road and Bridge Construction, Section 832.03(D)(p)

5. Enclosures - Furnish and install electrical enclosures in accordance with Contract Plans and as noted herein.

a. Junction Wells

i. Excavate to the required depth in accordance with DelDOT Standard Detail T-1-3. Construct a stone base for the junction well. Compact the foundation,

upon which the junction well is to be placed, to a firm, even surface to the acceptance of the Engineer

ii. Provide conduit junction well conforming to the manufacturer's specifications. More than one conduit may extend into the well

iii. Set conduit junction well

iv. Set cast iron frame and lid

1. Set cast iron frame and lid and cover above grade and graded to drain away from the junction well in conformance with the Contract Documents when constructed in unpaved areas

v. Backfill the area around the well with Borrow Type C Material to the required elevation in accordance with Section 207 and dispose of excess or unsuitable material per Section 106.08 of DelDOT Standard Specifications of Road and Bridge Construction

vi. Ground and bond junction well in accordance with Construction Methods Section 2(C) herein

b. Junction Boxes

i. Embedded junction boxes shall be oriented and secured to rebar during the casting process such that the junction box cover will be flush with the cast parapet barrier after casting

ii. Exposed junction boxes shall be secured using type 316 stainless steel mounting hardware designed for mounting on concrete structures

iii. All junction boxes shall be properly grounded in accordance with Construction Methods Section 2(D) herein

6. Electrical Testing - Perform all system testing for lighting installations by a third-party licensed master electrician in the State of Delaware.

Test insulation from ground, roadway lighting, performance (burn-in) and illuminance circuits as follows:

a. Insulation from Ground. Test all underground circuits for resistance to ground with a megger both before and after the conduit and wiring have been buried and all ground rods have been installed and connected. Circuit measurement readings less than 10 megaohms to ground are not acceptable. Inspect, repair and retest failing circuits.

b. Marine Navigation Lighting Circuits. Determine the insulation resistance on all cables of every circuit, except those installed in lighting fixtures. Cable insulation resistance measurement readings less than 10 megohms at 500 volts D.C. are not acceptable. If the insulation resistance test of any conductor is less than 10 megaohms, locate the fault. If the fault is in a conductor between terminal connections, replace the conductor. If the fault is at a terminal connection, repair or

replace the terminal device. Removing water from the conduit of a fault circuit is not considered a repair. If a circuit fails the insulation resistance test and removing water allows the circuit to pass, replace the conductors and re-test the new circuit. Endure the duration of circuit testing and any re-test is at least one minute.

Demonstrate to the Engineer that all conductors are continuous, free from short circuits and unspecified grounds, and that all circuits are properly connected.

Take voltage readings, with load and without load, at the power supply side of the control cabinet main breaker. The readings with load must be within +/- 5 percent of nominal voltage. Take voltage readings at the last light of each circuit. A voltage reading is acceptable if it is within 5 percent of the reading with load at the supply point.

Take current (ampere) readings with a full lighting load on the load side of each distribution breaker in the control cabinet. A current reading is acceptable if it does not exceed 80 percent of the breaker rating.

c. Performance (burn-in). After all issues mentioned in previous tests have been addressed to the satisfaction of the Engineer, perform a 2 week burn-in test on the lighting system. The burn-in test consists of normal dusk-to-dawn operation of all lighting system control Equipment and apparatus to ensure function without interruption or failure. Conduct the burn-in test at the same time for all lights that are energized from the same utility company service point. Burn-in test of individual circuits or groups of lights will not be acceptable.

   At the end of the burn-in test, inspect all lights and Equipment for normal operation. Correct failures occurring during the test period. Make any necessary repairs or replacements at no cost to the Department. Perform a retest on the repair portion of the system.

d. After the lights have been energized for the minimum 2 week burn-in period, arrange a night-time inspection with the Department's Master Electrician to determine the optical qualities of each luminaire. Adjust all luminaires having unsatisfactory qualities as directed. Submit test procedures to the Engineer for approval two weeks prior to conducting the test. Submit four copies of the test results to the Engineer.

7. Navigation Lights – Furnish and install Navigation Lights in accordance with Contract Plans and as noted herein.

   a. Span Navigation lights shall be mounted to the structure in accordance with Contract Plans.

   b. Pier Navigation lights shall be mounted to the structure in accordance with Contract Plans.

   c. All navigation lights shall be provided in accordance with all rules and regulations of the United States Coast Guard.

   d. Temporary navigation lights shall conform with all rules and regulations of the United States Coast Guard.

e. Navigation lights shall be operable and operating at any time the waterway is obstructed by the bridge span. Temporary lighting shall remain in place during demolition and upon obstructing the waterway with the new span(s) when the navigable channel becomes obstructed.

Method of Measurement:

This work will not be measured for payment.

Basis of Payment:

Price and payment for Navigation Lights For Fixed Bridges constitutes full compensation for the cost of all materials, labor, equipment, testing, testing equipment, and all incidentals necessary for a complete installation, ready for operation.

03/13/2020

Addendum No. 1
August 31, 2020

625501 - POLYESTER POLYMER CONCRETE OVERLAY INSTALLATION

625502 - FURNISHING POLYESTER POLYMER CONCRETE OVERLAY

625.01 Description.

Furnish materials and construct concrete overlay on concrete deck surfaces where shown in the Contract Documents or as directed by the Engineer.

625.02 Materials.

A. Furnish a high molecular weight methacrylate primer in accordance with Section 1045.04.

B. Furnish aggregate and finishing sand in accordance with Section 1003 and the following:

1. Use the following gradation requirements:

Combined Aggregate		
Sieve Size	**3/8" Max. Percent Passing**	**#4 Sieve Max. Percent Passing**
½"	100	100
3/8"	83-100	100
#4	65-82	62-85
#8	45-64	45-67
#16	27-48	29-50
#30	12-30	16-36
#50	6-17	5-20
#100	0-7	0-7
#200	0-3	0-3

2. Aggregate retained on the #8 sieve must have a maximum of 45 percent crushed particles when tested in accordance with AASHTO Test Method T27.

3. Fine aggregate must consist of natural sand only.

4. Aggregate absorption must not exceed one percent as determined by AASHTO Test Methods T84 and T85.

5. At the time of mixing with the resin, the moisture content of the aggregate, as determined by AASHTO Test Method T 255, must not exceed one half of the aggregate absorption.

6. Finish sand must be a dry No. 8/20 commercial quality blast sand.

C. Furnish a polyester binder consisting of polyester resin binder and dry aggregate.

1. The resin must be an unsaturated isophthalic polyester-styrene co-polymer conforming to the following:

Polyester Resin Binder		
Property	**Requirement****	**Test Method**
Viscosity* (RVT No. 1 Spindle, 20 RPM at 77°F)	0.075 to 0.20 Pa•s	ASTM D 2196
Specific Gravity*	1.05 to 1.10 at 77°F	ASTM D 2196
Elongation	35 percent minimum Type I at 0.45"/min. Thickness = 1/4" ± 0.04"	ASTM D 638
		ASTM D 618

	Sample Conditioning: 18/25/50 + 5/70	
Tensile Strength	17.5 Mpa Minimum Type I at 0.45"/min. Thickness = 1/4" ± 0.04"	ASTM 638
	Sample Conditioning: 18/25/50 ± 5/70	ASTM 618
Styrene Content*	40 percent to 50 percent (by weight)	ASTM D 2369
Silane Coupler	1.0 percent, minimum (by weight of polyester styrene resin)	
PCC Saturated Surface Dry Bond Strength	3.5 Mpa, minimum at 24 hours and 70±1°C	
*Tested prior to adding initiator		
**Values are based on specimens or samples cured or aged at 77°F unless otherwise indicated.		

2. The silane coupler must be an organosilane ester, gammamethacryloxypropyltrimethoxysilane. The promoter shall be compatible with methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxice (CHP) initiators.

D. Submit samples of materials for all components of the overlay system to the Materials and Research Section a minimum of sixty (60) days prior to the overlay application. Samples shall be representative of the materials to be used in the overlay application and shall consist of one four-liter sample for each liquid component and a 5 pound sample for each dry component.

E. Furnish a Material Safety Data Sheet prior to use for each shipment of polyester resin binder and high molecular weight methacrylate resin. All components shall be shipped in strong, substantial containers, bearing the manufacturer's label specifying date of manufacture, batch number, brand name, quantity, and date of expiration or shelf life. In addition, the mixing ratio shall be printed on the label of at least one of the system components. If bulk resin is to be used, the Contractor shall notify the Engineer in writing 10 days prior to the delivery of the bulk resin to the job site. Bulk resin is any resin that is stored in containers in excess of 55 gallons.

F. **Basis of Acceptance.** Project acceptance of the polyester overlay materials will be based on the following:

1. Delivery of the overlay materials to the project site in acceptable containers bearing all the label information as required in 1045.04©.

2. Receipt of a manufacturer's certification stating the primer, aggregate and polyester binder meet the material requirements found above.

3. Approval by the Materials and Research Section based on conformance with the material requirements above.

625.03 Construction.

1. General.

a. At least ten (10) days before start of work, provide the Engineer with two (2) copies of the manufacturer's written instructions for the installation of the overlay system.

b. Ensure that the manufacturer's technical representative is available for up to three (3) working days to make recommendations to facilitate the overlay installation, including surface preparation, overlay application, and overlay cure.

c. During surface preparation and overlay application, take precautions to assure that traffic is protected from rebound, dust, and construction activities. Provide appropriate shielding as required and directed by the Engineer.

d. During overlay application, provide suitable coverings (e.g. heavy duty drop cloths) to protect all exposed areas not to be overlaid, such as curbs, sidewalks, parapets, etc. Clean and/or repair all damage or defacement resulting from this application to the Engineer's satisfaction at no additional cost.

2. Storage of Materials.

a. Store all materials in accordance with the manufacturer's recommendation to ensure their preservation until used in the work. Applicable fire codes may require special storage facilities for some components of the overlay system.

3. Equipment.

a. Surface Preparation.

i. Use only equipment for surface preparation that is specified by the overlay manufacturer and approved by the Engineer. Unless otherwise specified, use automatic shot blasting units to clean pavement surfaces. The automatic shot blasting units are to be self propelled and include a vacuum to recover spent abrasives, and the abrasives are to be steel shot. In those areas not accessible to this machinery, the surface may, with the Engineer's approval, be cleaned with blast cleaning equipment. Use magnetic rollers to remove any spent shot remaining on the deck after vacuuming.

b. Application.

i. Mix polyester concrete in mechanically operated mixers no larger than 9 cubic feet in capacity. A continuous mixer employing an auger screw/chute device may be approved by the Engineer if a demonstration shows its ability to produce a satisfactory product. The continuous mixer must 1) be equipped with a metering device that automatically measures and records the aggregate volumes and the corresponding resin volumes and 2) have a readout gage, visible to the Engineer at all times, that displays the volumes being recorded. Record the volumes at no greater than five (5) minute intervals along with the time and date of each recording. Furnish a printout of the recordings to the Engineer at the end of each work shift.

c. Finishing and Texturing.

i. Use an approved finishing machine complying with Section 610.03(E)(4)(c)(i) and having a vibrating pan to properly consolidate the mix.

4. Surface Preparation.

a. Prepare all structural slab surfaces that will be in contact with the overlay as follows:

i. Determine the size of shot, flow of shot, forward speed of shot blast machine and number of passes necessary to provide a surface capable of a tensile bond strength greater than or equal to 250 psi or a failure area, at a depth of 1/8" or more into the base concrete, no greater than 50% of the test area. Perform the testing in accordance with ACI 503R-93, Appendix A. The Engineer will designate the location of the test patches.

ii. Before application of the primer, clean the entire deck area by shot blasting and other means using the approved cleaning practice to remove asphaltic material, oils, dirt, rubber, curing compounds, paint, carbonation, laitance, weak surface mortar and other potentially detrimental materials that may interfere with the bonding or curing of the overlay. Acceptable cleaning is usually achieved by significantly changing the color of the concrete and mortar and beginning to expose coarse aggregate particles. Mortar which is sound and firmly bonded to the coarse aggregate must have open pores due to cleaning to be considered adequate for bond. Remove areas of asphalt larger than 1 inch in diameter or smaller areas spaced 6 inches apart. Traffic paint lines will be considered clean when the concrete has exposed aggregate showing through the paint stripe. Use a vacuum cleaner to remove all dust and other loose material.

iii. If the Engineer determines that an approved cleaning practice has changed prior to the completion of the overlay application, the Contractor must return to the approved cleaning methods and re-clean the suspect areas or verify through tests at no additional cost to the Department that the practice is acceptable.

iv. Do not place the overlay until all patching and cleaning operations have been inspected and approved. Remove any contamination of the deck after initial cleaning. The entire overlay system may only be applied following the cleaning and prior to opening the area to traffic.

v. Do not expose cleaned pavement surfaces to vehicular or pedestrian traffic other than that required by the overlay operation. If the pavement is contaminated before being overlaid, re-clean the contaminated area by abrasive blasting to the satisfaction of the Engineer. No additional payment will be made for re-cleaning work.

vi. Ensure that the concrete is dry at the time of application of the overlay.

vii. Clean all steel surfaces that will be in contact with the overlay in accordance with SSPC-SP No. 10, Near-White Blast Cleaning, except that wet blasting methods shall not be allowed.

viii. After the cleaning operation is completed, ensure that there is no visible evidence of oil, grease, dirt, rust, loose particles, spent abrasives, or other foreign material on any of the surfaces to be overlaid.

5. Application.

a. Prime Coat

i. Prior to applying the prime coat, ensure the area is dry and blow the area clean with oil-free compressed air. The surface temperature must be at least 50ºF.

ii. Uniformly apply the prime coat to completely cover the surface to receive the polyester concrete. Use a rate of spread of approximately 2.3 ounces per square foot of deck surface or as recommended by the manufacturer. Allow the prime coat to cure a minimum of 15 minutes before placing polyester concrete.

iii. When magnesium phosphate concrete is placed prior to the deck overlay, place the magnesium phosphate concrete at least 72 hours prior to placing the prime coat.

iv. When modified high alumina based concrete is placed prior to the deck overlay, do not place the prime coat on said concrete until at least 30 minutes after final set.

b. Polyester Concrete

i. Test Patches

1.) Prior to constructing the overlay, place one or more trial overlays on a previously constructed concrete base to determine initial set time and to demonstrate the effectiveness of the mixing, placing, and finishing equipment proposed as well as curing period. Each trial overlay must be

12' wide, at least 6' long, and the same thickness as the overlay to be constructed, and the conditions during the construction of the overlay and equipment used should be similar to those expected and to be used for the construction of the polyester concrete overlay. If the cleaning practice, materials, and installation procedure are not acceptable, the Contractor must remove the failed test patches and make the necessary adjustments and test all test areas at no additional cost to the Department until satisfactory test results are obtained.

2.) The test patch must have a minimum bond strength of 250 psi as determined by ACI 503R-93, Appendix A to assure that the overlay adheres to the prepared surface.

3.) If required, remove and dispose of all material used in the trial overlay, including the concrete test patch.

ii. Place the polyester concrete at least 30 minutes but not more than 120 minutes after the prime coat has been applied.

iii. Ensure that the polyester concrete contains approximately 12 percent polyester resin by weight of dry aggregate; the exact percentage will be determined by the Engineer during placement to enable proper finishing and texturing of the overlay surface.

iv. Place the polyester overlay at a minimum thickness of ¾".

v. Termination edges of the overlay may require application and finishing by hand trowel due to obstructions such as a curb. Follow all hand troweling by broadcasting aggregate or surface texturing while the resin is still wet to provide acceptable surface friction characteristics.

vi. Adequately isolate expansion joints prior to overlaying or they may be sawed within four hours after overlay placement, as approved by the Engineer. The exact time of sawing will be determined by the Engineer.

vii. The amount of initiator used in polyester concrete must be sufficient to produce an initial set time between 30 and 120 minutes during placement. The initial set time will be determined by using an initial-setting time Gillmore needle in

accordance with the requirements of ASTM C266. Use accelerators or inhibitors as recommended by the resin supplier to achieve proper set times.

viii. Initiate and thoroughly blend the resin binder just prior to mixing with aggregate. Mix the polyester concrete a minimum of 2 minutes prior to placing.

ix. Place polyester concrete prior to gelling and within 15 minutes following addition of initiator, whichever occurs first. Discard polyester concrete that is not placed within this time.

x. The surface temperature of the area to receive polyester concrete must be the same as specified above for the prime coat, a minimum of 50ºF.

xi. Use the finishing and texturing equipment to strike off the polyester concrete to the established grade and cross section. Finishing and texturing equipment must be fitted with vibrators and tines or other means of consolidating and texturing the polyester concrete to the required compaction.

xii. Apply the finish sand by either mechanical means or hand broadcasting immediately after strike-off, before gelling occurs, and at a minimum rate of 2.75 ounces per square foot.

6. Surface and Thickness Requirements.

a. The overlay surface will be checked at random by the Engineer immediately after it has hardened to assure that no depressions exist that will pond water. The smoothness of the polyester concrete surface will be tested with a straightedge.

b. The surface must not vary more than ¼" from the lower edge of a 12' ±0.2' long straight edge placed in any direction. Remove any surfaces which fail to conform to the above tolerance by grinding with an approved grinding tool.

c. To ensure adequate pavement friction, the completed overlay surface must be free of any smooth or "glassy" areas such as those resulting from insufficient quantities of surface aggregate. Repair any such surface defects in the manner recommended by the manufacturer and approved by the Engineer.

d. Check the thickness of the overlay prior to its initial set using a ruler. If the Engineer determines that the minimum thickness has not been attained, apply an additional layer with a minimum thickness of ¼" after the overlay hardens at no additional cost to the Department.

7. Finishing.

a. Texture the surface in accordance with Subsection 610.03(E)(4)(c)(iv).

8. Curing.

a. Do not permit traffic and equipment on the overlay for a minimum of four (4) hours following final finishing. Protect overlay from moisture for a minimum of four (4) hours after finishing. Allow the polyester overlay to reach final cure before subjecting it to traffic loads. Cure time is dependent upon the ambient and deck temperatures. Actual degree of cure and suitability of the overlay for traffic will be determined by the Engineer.

625.04 Method of Measurement.

Polyester polymer concrete overlay will be paid separately at the Contract Unit Price for furnishing and installation of the overlay.

625.05 Basis of Payment.

A. Payment will be made for accepted quantities at the contract unit price as follows:

Item No.	Item Description	Unit
625501	POLYESTER POLYMER CONCRETE OVERLAY INSTALLATION	SY-IN
625502	FURNISHING POLYESTER POLYMER CONCRETE OVERLAY	CY

B. Price and payment for furnishing overlay constitutes full compensation for furnishing all materials, including the technical representative, needed to construct the overlay.

C. Price and payment for constructing overlay constitutes full compensation for the preparation of the area to receive overlay including scarifying, shot or grit blasting, removal of rust, oil and other contaminants, protecting the area, placing the bonding grout or primer coat, placing of concrete overlay, consolidating, curing, texturing, constructing and removing test patches, and for all labor, equipment, tools, and incidentals necessary to complete the work.

2/5/2018

625501 - POLYESTER POLYMER CONCRETE OVERLAY INSTALLATION
625502 - FURNISHING POLYESTER POLYMER CONCRETE OVERLAY

Description.

Furnish Materials and construct Polyester Polymer Concrete (PPC) overlay on concrete deck surfaces where shown in the Contract Documents or as directed by the Engineer.

Materials.

Provide Materials as specified in the following:

A. Furnish a High Molecular Weight Methacrylate (HMWM) primer in accordance with Subsection 1045.04.

B. Furnish aggregate and finishing sand in accordance with Section 1003 and the following:
   1. The organic impurities requirement will not be waived for PPC overlays.
   2. Use the following gradation requirements:

Combined Aggregate		
Sieve Size	**3/8" Max. Percent Passing**	**#4 Sieve Max. Percent Passing**
½"	100	100
3/8"	83-100	100
#4	65-82	62-85
#8	45-64	45-67
#16	27-48	29-50
#30	12-30	16-36
#50	6-17	5-20
#100	0-7	0-7
#200	0-3	0-3

2. Aggregate retained on the #8 sieve must have a maximum of 45 percent crushed particles when tested in accordance with AASHTO Test Method T27.

3. The minimum Mohs scale Hardness of the silica sand shall be 7.0 and all aggregates retained in the No. 8 sieve shall have a minimum hardness of 7.0.

4. Fine aggregate must consist of natural sand only.

5. Aggregate absorption must not exceed one percent as determined by AASHTO Test Methods T84 and T85.

6. At the time of mixing with the resin, the moisture content of the aggregate, as determined by AASHTO Test Method T255, must not exceed one half of the aggregate absorption.

7. Finish sand must be a dry No. 8/20 commercial quality blast sand.

C. Furnish a binder consisting of polyester resin binder and dry aggregate.

1. The resin must be an unsaturated isophthalic polyester-styrene co-polymer conforming to the following:

Polyester Resin Binder		
Property	**Requirement****	**Test Method**
Viscosity* (RVT No. 1 Spindle, 20 RPM at 77°F)	0.075 to 0.20 Pa·s	ASTM D2196
Specific Gravity*	1.05 to 1.10 at 77°F	ASTM D1475
Elongation	35 percent minimum Type I at 0.45"/min. Thickness = 0.25" ± 0.04"	ASTM D638
	Sample Conditioning: 18/25/50 + 5/70	ASTM D618
Tensile Strength	17.5 Mpa Minimum Type I at 0.45"/min. Thickness = 0.25" ± 0.04"	ASTM D638
	Sample Conditioning: 18/25/50 ± 5/70	ASTM D618
Styrene Content*	40 percent to 50 percent (by weight)	ASTM D2369
Silane Coupler	1.0 percent, minimum (by weight of polyester styrene resin)	
PCC Saturated Surface Dry Bond Strength	3.5 Mpa, minimum at 24 hours and 70±1℃	California Test Method 551
*Tested prior to adding initiator		
**Values are based on specimens or samples cured or aged at 77℉ unless otherwise indicated.		

2. The silane coupler must be an organosilane ester, gamma-methacryloxypropyltrimethoxysilane. The promoter shall be compatible with methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxice (CHP) initiators.

D. Samples

1. Submit samples of Materials for all components of the PPC overlay system to the Materials and Research Section a minimum of sixty (60) days prior to application

2. Samples shall be representative of the materials to be used in the PPC overlay system and shall consist of one four-liter sample for each liquid component (HMWM resin primer and polyester resin binder) and a 5-pound sample for each dry component. Appropriate amounts of catalysts and promoters shall be supplied with the one-gallon samples.

E. Packaging and Shipment

1. Furnish a Material Safety Data Sheet prior to use for each shipment of polyester resin binder and high molecular weight methacrylate resin.

2. Ship all components as specified in Subsection 1045.04.C.

F. Basis of Acceptance

1. Project acceptance of the PPC overlay materials will be based on the following:

a. Delivery of the overlay materials to the project site in acceptable containers bearing all the label information as required in Subsection 1045.04.C.

b. Receipt of a manufacturer's certification stating the primer, aggregate and polyester binder meet the material requirements above.

c. Approval by the Materials and Research Section based on conformance with the Material requirements above.

Construction.

A. Submittals

1. Prior to construction of the PPC overlay, the Contractor shall submit to the Engineer a Work Plan for constructing the PPC overlay. The Work Plan shall include, but not be limited to, the following:

a. A schedule and sequence of all overlay work.
b. Technical literature from the system provider including requirements for storage, handling, mixing, application, cleanup, and disposal of materials and containers.
c. Description of materials and test reports for all overlay system materials to be used.
d. Description of equipment for applying HMWM resin.
e. Description of equipment for measuring, mixing, placing, and finishing PPC overlay material.
f. Method for isolating bridge joints.
g. Location of proposed cold joints in PPC overlay.
h. Cure time for PPC overlay.
i. Description of equipment for applying sand.
j. Procedures for surface preparation, application, curing, and finishing.

2. In addition, the system provider's technical representative who will be on site shall also review and approve the Work Plan. Any deviations from the approved Work Plan shall be approved by the Engineer and system provider's technical representative.

B. General

1. At least ten (10) days before start of work, provide the Engineer with two (2) copies of the system provider's written instructions for the installation of the PPC overlay system.

2. Ensure that the system provider's technical representative is available for up to three (3) working days to make recommendations to facilitate the PPC overlay installation, including surface preparation, application, and cure.

3. During surface preparation and overlay application, take precautions to assure that traffic is protected from rebound, dust, and construction activities. Provide appropriate shielding as required and directed by the Engineer.

4 During overlay application, provide suitable coverings (e.g. heavy duty drop cloths) to protect all exposed areas not to be overlaid, such as curbs, sidewalks, parapets, etc. Clean and/or repair all damage or defacement resulting from this application to the Engineer's satisfaction at no additional cost to the Department.

C. Storage of Materials

Store all materials in accordance with the manufacturer's recommendation to ensure their preservation until used in the Work. Applicable fire codes may require special storage facilities for some components of the overlay system.

D. Equipment

1. *Surface Preparation.* Use only equipment for surface preparation that is specified by the PPC overlay system provider and approved by the Engineer. Unless otherwise specified, use automatic shot blasting units to clean pavement surfaces. The automatic shot blasting units are to be self-propelled and include a vacuum to recover spent abrasives. The abrasives shall be steel shot. In those areas not accessible to this machinery, the surface may, with the Engineer's approval, be cleaned with blast cleaning equipment. Use magnetic rollers to remove any spent shot remaining on the surface after vacuuming.

2. *Application.*

a. Mix polyester polymer concrete in mechanically operated mixers sufficient for complete mixing of batch and no larger than 9 cubic feet in capacity. Mixer shall be approved by system provider and Engineer. A continuous mixer employing an auger screw/chute device may be approved by the Engineer if a demonstration shows its ability to produce a satisfactory product. The continuous mixer must 1) be equipped with a metering device that automatically measures and records the aggregate volumes and the corresponding resin volumes and 2) have a readout gage, visible to the Engineer at all times, that displays the volumes being recorded. Record the

volumes at no greater than five (5) minute intervals along with the time and date of each recording. Furnish a printout of the recordings to the Engineer at the end of each work shift.

b. A minimum of four Class B fire extinguishers, five pound minimum, in good working order shall be mounted approximately equidistant around the perimeter of each mixer unit.

c. The capacity, operating speed, and all mix control constants shall be clearly and prominently mounted on the unit by the system provider in a durable metal plate or plates.

3. *Finishing.* Use an approved finishing machine complying with Subsection 610.03.E.4.c.i and having a vibrating pan to properly consolidate the mix.

4. *Texturing.* Use approved equipment for sawing longitudinal in accordance with Subsection 610.03.E.4.c.iv.

E. Surface Preparation

1. Prepare all structural slab surfaces that will be in contact with the overlay as follows:

a. Determine the size of shot, flow of shot, forward speed of shot blast machine and number of passes necessary to provide a surface capable of a tensile bond strength greater than or equal to 250 psi or a failure area, at a depth of 1/8" or more into the base concrete, no greater than 50% of the test area. Perform the testing in accordance with ACI 503R-93, Appendix A. The Engineer will designate the location of the test patches. A test result will be the average of three tests on a test patch of not less than 4.5 square feet. A minimum of one test result shall be obtained for each project bridge. Additional test patches may be required, up to one in each bridge span, as specified by the Materials and Research Section. The test patches shall be located to provide for the evaluation of the range of surface conditions on the bridge, and one or more patches shall be placed on deck repairs, if present. Test patches shall be installed using the procedures approved in the Work Plan. The cleaning practice, materials, and installation procedure will be approved if one passing test result is obtained from each test area when tested at an age of 24 hours or more. Tensile adhesion tests shall not be performed at surface temperatures above 80°F.

b. Before application of the primer, clean the entire deck area by shot blasting and other means using the approved cleaning practice to remove any epoxy resins, asphaltic material, oils, dirt, rubber, curing compounds, paint, carbonation, laitance, weak surface mortar and other potentially detrimental materials that may interfere with the bonding or curing of the overlay. Acceptable cleaning is usually achieved by significantly changing the color of the concrete and mortar and beginning to expose coarse aggregate particles. Mortar which is sound and firmly bonded to

the coarse aggregate must have open pores due to cleaning to be considered adequate for bond. Remove areas of asphalt larger than 1 inch in diameter or smaller areas spaced 6 inches apart. Traffic paint lines will be considered clean when the concrete has exposed aggregate showing through the paint stripe. Use a vacuum cleaner to remove all dust and other loose material.

c. If the Engineer determines that an approved cleaning practice has changed prior to the completion of the overlay application, the Contractor must return to the approved cleaning methods and re-clean the suspect areas or verify through tests that the practice is acceptable at no additional cost to the Department.

d. Do not place the overlay until all patching and cleaning operations have been inspected and approved. Remove any contamination of the deck after initial cleaning. The entire overlay system may only be applied following the cleaning and prior to opening the area to traffic.

e. Do not expose cleaned pavement surfaces to vehicular or pedestrian traffic other than that required by the overlay operation. If the pavement is contaminated before being overlaid, re-clean the contaminated area using approved cleaning practices to the satisfaction of the Engineer. No additional payment will be made for re-cleaning work.

f. Ensure that the concrete is dry at the time of application of the HMWM primer. If deemed necessary, the deck shall be tested for the presence of moisture in accordance with ASTM D 4263. Dryers may be used, as necessary, to facilitate the timely placement of the HMWM primer and PPC overlay materials.

g. Clean all steel surfaces that will be in contact with the overlay in accordance with SSPC-SP No. 10, Near-White Blast Cleaning, except that wet blasting methods shall not be allowed.

h. After the cleaning operation is completed, ensure that there is no visible evidence of oil, grease, dirt, rust, loose particles, spent abrasives, or other foreign material on any of the surfaces to be overlaid.

F. Application

1. *Prime Coat.*

a. The primer shall be placed within 24 hours of surface cleaning

Prior to applying the prime coat, ensure the area is dry and blow the area clean with oil-free compressed air. The surface temperature must be at least 40ºF and satisfy the system provider's requirements.

b. Uniformly apply the prime coat to completely cover the surface to receive the polyester concrete. Use a rate of spread of approximately 2.3 ounces per square foot of deck surface or as recommended by the system provider.

Allow the prime coat to cure a minimum of 15 minutes before placing polyester polymer concrete.

c. When magnesium phosphate concrete is placed prior to the deck overlay, place the magnesium phosphate concrete at least 72 hours prior to placing the prime coat.

d. When modified high alumina-based concrete is placed prior to the deck overlay, do not place the prime coat on said concrete until at least 30 minutes after final set.

2. Polyester Polymer Concrete

a. Test Patches

i. Prior to constructing the PPC overlay, place one or more trial overlays on a previously constructed concrete base to determine initial set time and to demonstrate the effectiveness of the mixing, placing, and finishing equipment proposed as well as curing period. Each trial overlay must be 12' wide, at least 6' long, and the same thickness as the overlay to be constructed, and the conditions during the construction of the overlay and equipment used should be similar to those expected and to be used for the construction of the PPC overlay. If the cleaning practice, materials, and installation procedure are not acceptable, the Contractor must remove the failed test patches and make the necessary adjustments and test all test areas at no additional cost to the Department until satisfactory test results are achieved.

ii. The test patch must have a minimum bond strength of 250 psi as determined by ACI 503R-93, Appendix A to assure that the overlay adheres to the prepared surface.

iii. If required, remove and dispose of all material used in the trial overlay, including the concrete test patch.

b. Calibration and general mixer operation shall be demonstrated on-site a minimum of five working days prior to anticipated use. The calibration will consist of a weight/volume determination made in a 0.25 cubic yard container, filled with the polyester polymer concrete to be used, struck, off, and the volume compared to the mixer output record or reading. When no longer required, as determined by the Engineer, the container and contents shall be discarded.

c. Place the polyester concrete at least 30 minutes but not more than 120 minutes after the prime coat has been applied.

d. Ensure that the polyester concrete contains approximately 12 percent polyester resin by weight of dry aggregate; the exact percentage will be determined by the system provider’s technical representative during placement to enable proper finishing and texturing of the overlay surface.

e. Place the polyester overlay at a minimum thickness of ¾".

f. Termination edges of the overlay may require application and finishing by hand trowel due to obstructions such as a curb. Follow all hand troweling by broadcasting aggregate or surface texturing while the resin is still wet to provide acceptable surface friction characteristics.

g. When multiple passes of the screed or paver are required to overlay the full bridge width, longitudinal termination edges shall be located at the edge of travel lane(s) and/or within two feet of the curb lines.

h. Adequately isolate expansion joints prior to overlaying.

i. The amount of initiator used in polyester concrete must be sufficient to produce an initial set time between 30 and 120 minutes during placement. The initial set time will be determined by using an initial-setting time Gillmore needle in accordance with the requirements of ASTM C266. Use accelerators or inhibitors as recommended by the system provider to achieve proper set times.

j. Initiate and thoroughly blend the resin binder just prior to mixing with aggregate. Mix the polyester polymer concrete a minimum of 2 minutes prior to placing.

k. Place polyester polymer concrete prior to gelling and within 15 minutes following addition of initiator, whichever occurs first. Discard polyester polymer concrete that is not placed within this time. Placing includes the broadcasting of finish sand, see below.

l. The surface temperature requirement of the area to receive polyester polymer concrete is the same as specified above for the prime coat.

m. Use finishing equipment to strike off the polyester polymer concrete to the established grade and cross section. Finishing equipment must be fitted with vibrators and tines or other means of consolidating and texturing the polyester concrete to the required compaction of not less than 97 percent in accordance with California Test Method 552.

n. Apply the finish sand by either mechanical means or hand broadcasting immediately after strike-off, before gelling occurs, and at a minimum rate of 2.75 ounces per square foot.

G. Surface and Thickness Requirements

1. The overlay surface will be checked at random by the Engineer immediately after it has hardened to assure that no depressions exist that will pond water. The smoothness of the polyester concrete surface will be tested with a straightedge.

2. The surface must not vary more than 0.25" from the lower edge of a 12' ±0.2' long straight edge placed in any direction. Remove any surfaces which fail to conform to the above tolerance by grinding with an approved grinding tool.

3. To ensure adequate pavement friction, the completed overlay surface must be free of any smooth or "glassy" areas such as those resulting from insufficient quantities of surface aggregate. Repair any such surface defects in the manner recommended by the system provider and approved by the Engineer at no additional cost to the Department.

4. Check the thickness of the overlay prior to its initial set using a ruler. If the Engineer determines that the minimum thickness has not been attained, apply an additional layer with a minimum thickness of ¼" after the overlay hardens at no additional cost to the Department.

H. Texturing

Texture PPC overlay by sawing longitudinal grooves after overlay has cured in accordance with Subsection 610.03.E.4.c.iv.

I. Curing

Do not permit traffic and equipment on the PPC overlay for a minimum of four (4) hours following final finishing. Protect the overlay from moisture for a minimum of four (4) hours after finishing. Allow the overlay to reach final cure before subjecting it to traffic loads. Cure time is dependent upon the ambient and deck temperatures. Actual degree of cure and suitability of the overlay for traffic will be determined by the Engineer.

Method of Measurement.

Polyester polymer concrete overlay will be paid separately at the Contract Unit Price for furnishing and installation of the overlay.

Basis of Payment.

A. Payment will be made for accepted quantities at the contract unit price as follows:

Item No.	Item Description	Unit
625501	POLYESTER POLYMER CONCRETE OVERLAY INSTALLATION	SY-IN
625502	FURNISHING POLYESTER POLYMER CONCRETE OVERLAY	CY

B. Price and payment for furnishing overlay constitutes full compensation for furnishing all materials, needed to construct the overlay.

C. Price and payment for constructing PPC overlay constitutes full compensation for the preparation of the area to receive overlay including scarifying, shot or grit blasting, removal of rust, oil and other contaminants, protecting the area, placing the bonding grout or primer coat, placing of concrete overlay, consolidating, curing, texturing, constructing and

removing test patches, and for all labor, equipment, tools, and incidentals, including the technical representative, necessary to complete the Work.

8/27/2020

Addendum No. 1
August 31, 2020

850532 - TEMPORARY LIGHTING

Description:

The item consists of designing, coordinating, furnishing all materials, and installing temporary lighting in accordance with the locations, notes, and details shown on the Plans, this Special Provision, and/or as directed by the Engineer.

Materials:

The Contractor shall furnish all the materials for each temporary lighting unit including but not limited to, 40 ft Class III Wood Poles, Triplex Service Cable Dead End Attachments, luminaire mounting supports and hardware, LED floodlight luminaire; and perform such and related work including installation and removal of wood poles, electric service on wood pole, removing the dead end and intermediate cable attachments, installation and removal of luminaries.

The poles shall be 40 ft Class III Wood Poles. The pole shall be set with the bottom approximately seven feet below grade. The nominal mounting height of the luminaire shall be at least 30 ft above the surface being illuminated.

The mounting hardware shall be aluminum or galvanized steel and be suitable for attachment to wooden poles. The arms are to be fastened to the poles by means of galvanized bolts. The bolts shall pass thru the mounting flange of the support, thru the pole and have a galvanized washer and nut on the other end.

The support shall meet or exceed the "Standard Specifications for Structural Support for Highway Signs, Luminaries and Traffic Signals".

All wiring for the electric service installation and the wiring for the individual luminaries shall be the responsibility of the Contractor. All wiring shall conform to the National Electric Code.

The new LED floodlight luminaire shall be of a wattage, lumen output and distribution necessary to provide the required illuminance levels noted in this Special Provision. The CRI shall be a minimum of 70, and the color temperature shall be between 3,000K and 4,500 K

The temporary lighting system shall be controlled by a photoelectric cell installed on each luminaire or at the control center location. The photoelectric control unit shall be rated at 1800 voltampere and 105-285 volt and shall have adjustable turn "On" and "Off" settings of 2.0 +20% FC and 5.0 to 7.0 +20% FC, respectively. The photoelectric control "On" and "Off" setting for dawn to dusk operations shall be preset at the factory to insure an accurate and uniform operation of all units. The photoelectric control unit shall be held in a locking type mounting receptacle prewired to quick disconnect plugs, with both of these prewired to a terminal board so that the luminaire may be energized simply by installing wire connections to the terminal board.

Ground rods shall be copper clad steel 3/4" diameter 10' long, complete with ground clamp and square head bolt, equal to Joslyn's Catalog No. J8350, Line Material Catalog No. 119960 or A. B. Chance Co., Catalog No. 8450.

Various other materials to be used for electrical work, such as the conduit grounding bushings, expansion fittings, grounding studs, anchor bolt assemblies for lighting standards, etc., shall conform to the National Electric Code.

Aluminum castings shall be manufactured in accordance with the requirements of ASTM B108.

Materials which are required but not covered in this Special Provision shall meet the material requirement of the Standard Specifications.

Construction Methods:

The Plans show, in general, a conceptual layout with the location and installation details of various electrical and relocated work to be performed under this Contract. It is the Contractor's responsibility to validate the conceptual layout by performing design and submitting it for approval following the procedure noted below.

It is the Contractor's responsibility to provide, at least sixty days prior to the installation of the Temporary Lighting, Temporary Lighting Design drawings to the Department for their review and approval. The Temporary Lighting Design drawings shall include the following:

1. Layout drawings showing the location of all temporary lighting equipment.
2. Details of lighting and electrical equipment to be used.
3. Details of electrical power source.
4. Specific technical details including catalog cuts on all lighting fixtures to be provided, including power rating and photometric charts.

5. Details of any hoods, louvers, shields or other means to control glare.

6. Lighting calculations confirming that the illumination requirements will be met by the Contractor's temporary lighting design.

7. Other design plans and details are requested by the Department to validate and approve the Contractor's temporary lighting design.

The layout drawings shall be on sheet size approved by the Engineer and at an appropriate scale to adequately describe the work. Layout drawings must be submitted and approved for all Phases of Construction.

The Temporary Lighting design shall provide at least 5.0 average maintained foot-candles with an average / minimum uniformity ratio of approximately 15:1 or less across the pavement of the court.

When there is no longer a requirement on the site for the temporary lighting units, the wood poles and luminaries shall become the Contractor's property.

The Contractor shall coordinate all the necessary activities for electrical power with the owner of the Electrical Utility in the area and obtain the required electrical service.

It is the Department's intent to provide a continuously operating temporary lighting system. Should an operational problem be reported to the Contractor at any time during use of the unit, the Contractor shall have 30 minutes after receipt of notification to rectify the problem to the Engineer's satisfaction. Failure of the Contractor to make this effort may result in deduction of payment for the time the system is not satisfactorily operating. To this end, the Contractor shall designate an on-site representative, other than the Project Superintendent, who shall be the Department's contact person on all issues related to the temporary lighting system. The Contractor shall also designate a Manufacturer's Representative to be on call for technical assistance or as otherwise necessary.

Basis of Payment:

Payment for the temporary lighting shall be made at the lump sum unit price for the "Temporary Lighting" item, which price and payment shall constitute full compensation for designing, coordination, furnishing and installing all materials including, but not limited to, all the work and materials mentioned above in this Special Provision; for all switches, hardware, attachments, appurtenances and incidentals necessary to make the temporary lights safe, operational and functional, during the period required on the job, for removal of all materials when no longer required and for all labor, tools and equipment necessary to complete the item.

The Contractor shall be responsible for all electrical connection and service charges required for the temporary lighting and shall make payments directly to the Electrical Utility Company.

850532 - TEMPORARY LIGHTING

Description:

The item consists of designing, coordinating, furnishing all materials, installing and removing temporary lighting in accordance with the locations, notes, and details shown on the Plans, this Special Provision, and/or as directed by the Engineer.

Materials

The Contractor shall furnish all the materials for each temporary lighting unit including but not limited to, 40 ft (12 m) Class III Wood Poles, Triplex Service Cable Dead End Attachments, luminaire mounting supports and hardware, LED luminaires; and perform such and related work including installation and removal of wood poles, electric service on pedestal, removing the dead end and intermediate cable attachments, installation and removal of luminaries.

The poles shall be 40 ft (12 m) Class III Wood Poles. The pole shall be set with the bottom approximately seven feet below grade. The nominal mounting height of the luminaire shall be at least 35′ (9.0m) above the surface being illuminated.

The mounting hardware shall be aluminum or galvanized steel and be suitable for attachment to wooden poles. The arms are to be fastened to the poles by means of galvanized bolts. The bolts shall pass thru the mounting flange of the support, thru the pole and have a galvanized washer and nut on the other end.

The support shall meet or exceed the "Standard Specifications for Structural Support for Highway Signs, Luminaries and Traffic Signals".

All wiring for the electric service installation and the wiring for the individual luminaries shall be the responsibility of the Contractor. All wiring shall conform to the National Electric Code.

The new LED luminaires shall be of a wattage, lumen output and distribution as noted on the plans. The CRI shall be a minimum of 70, and the color temperature shall be between 3,000K and 4,500 K.

The temporary lighting system shall be controlled by a photoelectric cell installed on each luminaire. The photoelectric control unit shall be rated at 1800 voltampere and 105-285 volt and shall have adjustable turn "On" and "Off" settings of 2.0 ±20% FC and 5.0 to 7.0 ±20% FC, respectively. The photoelectric control "On" and "Off" setting for dawn to dusk operations shall be preset at the factory to insure an accurate and uniform operation of all units. The photoelectric control unit shall be held in a locking type mounting receptacle prewired to quick disconnect plugs, with both of these prewired to a terminal board so that the luminaire may be energized simply by installing wire connections to the terminal board.

Ground rods shall be copper clad steel 3/4" (19 mm) diameter 10′ (3 m) long, complete with ground clamp and square head bolt, equal to Joslyn's Catalog No. J8350, Line Material Catalog No. 119960 or A. B. Chance Co., Catalog No. 8450.

Various other materials to be used for electrical work, such as the conduit grounding bushings, expansion fittings, grounding studs, anchor bolt assemblies for lighting standards, etc., shall conform to

the National Electric Code.

Aluminum castings shall be manufactured in accordance with the requirements of ASTM B108.

Materials which are required but not covered in this Special Provision shall meet the material requirement of the Standard Specifications.

Construction Methods:

The Plans show, in general, a conceptual layout with the location and installation details of various electrical and relocated work to be performed under this Contract. It is the Contractor's responsibility to validate the conceptual layout by performing design and submitting it for approval following the procedure noted below.

It is the Contractor's responsibility to provide, at least sixty days prior to the installation of the Temporary Lighting, Temporary Lighting Design drawings to the Department for their review and approval. The Temporary Lighting Design drawings shall include the following:

1. Layout drawings showing the location of all temporary lighting equipment.
2. Details of lighting and electrical equipment to be used.
3. Details of electrical power source.
4. Specific technical details including catalog cuts on all lighting fixtures to be provided, including power rating and photometric charts.
5. Details of any hoods, louvers, shields or other means to control glare.
6. Lighting calculations confirming that the illumination requirements will be met by the Contractor's temporary lighting design.
7. Other design plans and details are requested by the Department to validate and approve the Contractor's temporary lighting design.

The layout drawings shall be on sheet size approved by the Engineer and at an appropriate scale to adequately describe the work. Layout drawings must be submitted and approved for all Phases of Construction.

The Temporary Lighting design shall provide at least 0.9 average maintained foot-candles with an average / minimum uniformity ratio of approximately 3.0:1 or less across the crossover pavement.

When there is no longer a requirement on the site for the temporary lighting units, the wood poles and luminaries shall become the Contractor's property.

The Contractor shall coordinate all the necessary activities for electrical power with the owner of the Electrical Utility in the area and obtain the required electrical service.

It is the Department's intent to provide a continuously operating temporary lighting system. Should an operational problem be reported to the Contractor at any time during use of the unit, the Contractor shall have 24 hours after receipt of notification to rectify the problem to the Engineer's satisfaction. Failure of the Contractor to make this effort may result in deduction of payment for the time the system is not satisfactorily operating. To this end, the Contractor shall designate an on-site representative, other than the Project Superintendent, who shall be the Department's contact person on all issues related to the temporary lighting system. The Contractor shall also designate a Manufacturer's Representative to be on call for technical assistance or as otherwise necessary.

Basis of Payment:

Payment for the temporary lighting shall be made at the lump sum unit price for the "Temporary Lighting" item, which price and payment shall constitute full compensation for design, coordination, furnishing and installing all materials including, but not limited to, all the work and materials mentioned above in this Special Provision; for all switches, hardware, attachments, appurtenances and incidentals necessary to make the temporary lights safe, operational and functional, during the period required on the job, for removal of all materials when no longer required and for all labor, tools and equipment necessary to complete the item.

The Contractor shall be responsible for all electrical connection and service charges required for the temporary lighting and shall make payments directly to the Electrical Utility Company.

03/13/2020