June 2, 2010

SPECIAL PROVISION

PROJECT # F-I84-6(97)108
PIN # 6560

SECTION 03339S

PRECAST CONCRETE DECK PANEL

Delete Section 03339 in its entirety and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This work consists of furnishing, erecting, and installing all precast concrete deck panels including all necessary materials and equipment to complete the work as shown on the plans. The use of cast-in-place concrete is not an acceptable alternative for precast panels.

B. Procedures for preparing and installing structural non-shrink grout.

C. Placing structural non-shrink grout into the camber strips, filling the shear stud blockouts and, all other blockouts in the bridge precast concrete deck panels to produce a finished deck.

D. Procedures relating to preparing bridges for widening and grinding deck panels.

E. Procedures relating to installing new shear studs on top flanges of existing steel girders and installing shear connectors to the top flanges of existing concrete or prestressed beams as shear studs.

F. Procedures for full depth precast concrete deck panel.

1.2 RELATED SECTIONS

A. Section 02982: Bridge Concrete Grinding

B. Section 03055: Portland Cement Concrete

C. Section 03211: Reinforcing Steel and Welded Wire

D. Section 03251S: Post Tensioning Concrete

E. Section 03310: Structural Concrete

F. Section 03372: Thin Bonded Polymer Overlay

G. Section 03412: Prestressed Concrete

1.3 REFERENCES

A. AASHTO M 111: Standard Specifications for Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shape Plates, Bars, and Strip

B. AASHTO M 169: Standard Specification for Steel Bars, Carbon and Alloy, Cold-Finished

C. AASHTO M 235: Standard Specification for Epoxy Resin Adhesives

D. AASHTO M 270: Structural Steel for Bridges

E. AASHTO T 106: Compressive Strength of Hydraulic Cement Mortar

F. AASHTO T 160: Length Change of Hardened Hydraulic Cement Mortar and Concrete

G. AASHTO T 161: Standard Method of Test for Resistance of Concrete to Rapid Freezing and Thawing

H. AASHTO T 260: Standard Method of Test for Sampling and Testing Chloride Ion in Concrete and Concrete Raw Materials

I. AASHTO/AWS D1.5 2008 Bridge Welding Code

J. ASTM A 108: Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

K. ASTM A 109: Standard Specification for Steel Carbon Cold-rolled Strip

L. ASTM A 500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

M. ASTM A 706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

N. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete

O. ASTM C 666: Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

P. ASTM C 882: Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear

Q. ASTM E 1512: Standard Test Methods for Testing Bond Performance of Bonded Anchors

R. ANSI/AWS C 6.2-89: Specification for Friction Welding of Metals

S. PCI Design Handbook, Fifth Edition with all Interims and Errata

T. UDOT Quality Management Plan

1.4 DEFINITIONS NOT USED

1.5 SUBMITTALS

A. Submit the following to the Engineer for written approval:
   1. Shop Drawings:
      a. Submit five sets half-size, 11 x 17 inch sheets with a 1½ inch blank margin on the left-hand edge.
      b. Place the project designation data in the lower right-hand corner of each sheet.
      c. Prepare shop drawings stamped by a Professional Engineer licensed in Utah.
      d. Design, show, and locate all lifting inserts, hardware or devices, and vertical adjustment hardware on the shop drawings for the Engineer's approval. Design lifting hardware according to the provisions of Chapter 5 of the PCI Design Handbook.
      e. Show type and size of longitudinal post-tensioning anchorage assembly and ducts. Design local zone reinforcing for the anchorage assembly.
      f. Submit a Certificate of Compliance for non-shrink grout to the Engineer for approval.
      g. Do not order materials or begin work until receiving final approval of the shop detail drawings.
      h. Do not deviate from the approved shop drawings unless authorized in writing. Contractor is responsible for costs incurred due to faulty detailing or fabrication.

i. The Engineer reserves the right to retain these drawings up to 14 calendar days without granting an increase in the number of working days on the project. This duration is reduced to 7 days when the drawings are submitted electronically. This right applies each time the drawings are submitted or re-submitted. The Department will reject units fabricated before receiving written approval.

2. Erection Plans:
   a. Submit five sets half-size, 11 x 17 inch sheets with a 1½ inch blank margin on the left-hand edge.
   b. Place the project designation data in the lower right-hand corner of each sheet.
   c. Prepare drawings and supporting calculations stamped by a Professional Engineer licensed in Utah.
   d. Check that all handling and erection bracing conform to Chapter 5 of the PCI Design Handbook.
   e. Include the following at a minimum on the erection plans:
      1) Minimum clearances of reinforcing to panel edges.
      2) Locations and details of lifting devices including supporting calculations. Design all lifting devices based on the no cracking criteria in Chapter 5 of the PCI Design Handbook.
      3) Type and amount of any additional reinforcing required.
      4) Calculations showing that tensile stresses on both faces do not exceed the modulus of rupture during the handling, fabrication; shipping, and erection of the panel.
      5) Minimum compressive strength attained prior to handling the panels.
      6) Load distribution.
      7) Cables and lifting equipment.
      8) Details of vertical adjusting hardware.
   f. Include details showing the erection and installation of the proposed deck panels in accordance with the design plans.
   g. Submit Erection Plan drawings including the following minimum information:
      1) Crane and pick locations
      2) Crane charts
      3) Panel erection and sequence
   h. Submit to the Engineer for review a proposed method for forming the camber strips and installing the structural non-shrink grout, sequence, and equipment for grouting operation. Obtain approval prior to placing structural non-shrink grout begins.
   i. Submit a method of forming closure pours at joints between precast panels.

j. The Engineer reserves the right to retain these drawings up to 14 calendar days without granting an increase in the number of working days on the project. This duration is reduced to 7 days when the drawings are submitted electronically. This right applies each time the drawings are submitted or re-submitted.

3. Submit substitutions for self-consolidating concrete (SCC) mix designs to the Engineer for approval as an alternate to the structural concrete for the precast deck panels.

B. Submit for Materials. Refer to this Section, article 2.1.
1. Supply test data such as slump, air voids, or unit weight after 7, 14, and 28 days for fresh concrete and compressive strengths for the hardened concrete.

C. Submit for High Early Strength Concrete. Refer to this Section, article 2.1, paragraph H.
1. Submit material data information that states the percentage of each component used.
2. Provide substantive data at least two weeks prior to use that demonstrates the ability of the material to meet the specification requirements with the proposed mix design regardless of the type of high early strength concrete proposed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mild Reinforced Panel: Use Class AA (AE) concrete for precast concrete deck panels as specified in Section 03055 and on the plans.

B. Prestressed Panel: Use Class AA (AE) concrete according to Section 03055 except as modified by Section 03412 for Prestressed Concrete Panels. Use ¾ inch nominal aggregate.

C. Use coated reinforcing steel as specified in Section 03211.

D. Use mechanical threaded couplers when specified for precast concrete deck panel reinforcing according to Section 03211.
1. Do not use lap splices for mild reinforcement within the panel.
2. Lap splices are acceptable in cast-in-place closure pours.

E. Use embedded prefabricated steel pocket blockouts when shown on the plans that conform to the following:
1. Use cold formed rectangular steel tubing meeting the requirements of ASTM A 500 Grade B.

2. Use a steel top plate meeting the requirements of AASHTO M 270 Grade 36. Higher strength grades of steel may be substituted with prior approval from the Engineer.
3. Galvanize the steel assembly after fabrication according to the requirements of AASHTO M 111.
4. Use plastic pipe for grout ports and vents.

F. Use lifting devices that meet the following criteria:
1. Use devices that can support the required vertical and horizontal forces with the applicable safety factors as specified in the PCI Design Handbook, Chapter 5.
2. Use a device that will have 2¾ inch top cover and 1 inch bottom cover after installation. This may require partial removal of the device after installation.
3. Galvanize the leveling device after fabrication according to the requirements of AASHTO M 111.

G. Use structural non-shrink grout for camber strips, shear stud blockouts, keyway blockouts, and other blockouts shown on the plans.
1. Use a mix design according to Section 03055 if adding more than 15 lb of coarse aggregate (size No. 8) or larger per 50 lb bag of structural non-shrink grout.
2. Mix structural non-shrink grout just prior to use according to the manufacturer's instructions.
3. Use non-shrink, gray grout concrete containing no calcium chloride or admixture containing calcium chloride or other ingredient in sufficient quantity to cause corrosion to steel reinforcement.
4. Follow manufacturer's recommendation for corrosion inhibitor admixture dosage.
5. Use quick-setting, rapid strength gain, non-shrink, and high-bond strength grout.
6. Warranty the in-place structural non-shrink grout performance and workmanship for two years.
7. Repair or refund at the Department's option any bonding failures that occur during the warranty period.

8. Refer to Table 1 for structural non-shrink grout requirements.

Table 1

Structural Non-Shrink Grout			
***Properties**	**Requirements**	**ASTM**	**AASHTO**
Accelerated Weathering	As Specified in ASTM or AASHTO	C 666	T 260
Compressive Strength	>5,000 psi @ 28 days		T 106
Accepted Bond Strengths	>1,000 psi @ 24 Hours	C 882	
Test Medium	<3% White Utah Road Salt		T 161
Accepted Weight Loss	<15% @ 300 Cycles		T 161
Length Change	No expansion after 7 days		T 160

*Certified test results from a private AASHTO accredited testing laboratory will suffice for acceptance.

H. High Early Strength Concrete for closure pours: Use one of the following methods:

1. Design a high early strength concrete mix and obtain the Engineer's approval.
   a. Use air-entraining, Portland cement, fine and coarse aggregates, admixtures, water, and additives.
   b. Use between 4 to 7 percent-entrained air.
   c. Develop a mix that can attain a 6-hour compressive strength of 2,500 psi and a 7-day compressive strength of 4,000 psi.
   d. Develop a mix that contains shrinkage compensating additives such that there will be no separation of the closure pour concrete from the adjacent precast concrete.
   e. Use a shrinkage-compensating additive that produces expansion in the high early strength concrete of no more than 3 percent.
2. A proprietary concrete mix that meets the same physical requirements as those stated above may be used.

2.2 CONCRETE CORROSION INHIBITOR ADMIXTURE

A. The concrete corrosion inhibitor admixture will contain a minimum of 30 percent calcium nitrite by mass and formulated to meet ASTM C 494 requirements for Type C, accelerating admixture.

B. Use a dosage rate of 4 gal/yd^3 unless otherwise directed by the manufacturer.

C. Use the admixture in all new concrete and grout placed.

2.3 PRESTRESSING STRAND, POST TENSIONING AND SHEAR CONNECTORS

A. Refer to Section 03412: Prestressed Concrete for requirements.

B. Refer to Section 03251S: Post Tensioning Concrete for bar, strand, grout and other requirements.

C. Fabricate new shear studs from cold-drawn bars, Grades 1015, 1018 or 1020, conforming to AASHTO M 169 standard quality, and have a minimum tensile strength of 60.0 ksi.
   1. Use headed anchor studs for shear connectors conforming to dimensions showing on the plans.
   2. Use steel conforming to the requirement of AASHTO M 169.
   3. Automatically end weld studs in the shop or field with equipment designed for stud welding operations.
   4. Use equipment having capacity adequate for the size of stud welded.

D. Use a low carbon grade suitable for welding that will conform to ASTM A 109 for the caps if steel, flux-retaining caps are used.

E. Concrete girders:
   1. Use T- Headed bars consisting of deformed rebar with steel plates friction-welded to one end of the rebar. Friction welding conforms to the approved quality control manual and the Specification for Friction Welding of Metals, ANSI/AWS C6.2.
   2. Use deformed rebar that conforms to ASTM A 706, Grade 60.
   3. Cut plate heads for T-Headed bars from flats of hot-rolled steel conforming to ASTM A 108.
   4. Use an approved epoxy grout to develop minimum pullout strength in T-headed bar anchorage as shown on the Plan.

2.4 ADHESIVE DOWELED ANCHORS

A. Use Epoxy resin adhesive for anchors that conform to AASHTO M 235 Standard Specification for Epoxy Resin Adhesives.

2.5 QUALITY ASSURANCE

A. The Department pre-qualifies pre-cast and site-cast fabricators according to the UDOT Quality Management Plan: Pre-cast/Prestressed Concrete Structures. Only fabricators pre-qualified in Category Two will be accepted.

B. Permanently mark each precast unit with date of casting and supplier identification. Stamp markings in fresh concrete.

C. Prevent cracking or damage during handling and storage of precast units.

D. Defects and Breakage of Prestressed and Nonstressed Elements:
   1. Elements that sustain damage or surface defects during fabrication, handling, storage, hauling, or erection are subject to review and rejection.
   2. Write proposed repair procedures and obtain approval before performing repairs.
   3. Repair work must reestablish the element's structural integrity, durability, and aesthetics to the satisfaction of the Engineer.
   4. Determine the cause of any damage and take corrective action.
   5. Failure to take corrective action leading to similar repetitive damage is cause for rejection of the damaged elements.
   6. 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.
   7. Full depth cracking and breakage greater than 12 inches in length are cause for rejection.

E. Construct panels to tolerances shown on the plans or in the specifications.

PART 3 EXECUTION

3.1 FABRICATION

A. Do not place concrete in the forms until the Engineer has inspected and approved the placement of all materials in the deck panels.

B. Finish the precast concrete deck panels following Section 03310.

C. Wet cure the deck panels for 14 consecutive days. This cure is to begin immediately after performing the final finish.
   1. Wet cure panels by covering all exposed surfaces with wet burlap, cotton mats, or both, and plastic sheets.
   2. Maintain a saturated condition for the burlap and cotton for the entire duration of the 14 days.

D. Perform prestressing according to Section 03412 Prestressed Concrete.

E. Do not strip the forms before the precast panels have obtained a minimum compressive strength of 500 psi.

3.2 NEW SHEAR STUDS ON EXISTING STEEL GIRDERS AND CONCRETE BEAMS

A. Installation of the Shear Connectors
   1. Install shear connectors at the locations shown on the plans.
   2. Weld shear studs to steel girders or plates embedded in prestressed concrete according to AWS specifications.
      a. Adjust studs as necessary to provide clearance for bolts in existing bolted splices.
      b. Use method and equipment recommended by the manufacturer of the studs and approved by the Engineer.
      c. Field weld studs using friction welding. Conform to the approved quality control manual and the Specification for Friction Welding of Metals ANSI/AWS C.6.2-89.
   3. Field drill holes in the top flange of existing concrete and prestressed concrete beams and install shear studs according to manufacturer's recommendations.
      a. Locate all internal beam reinforcing prior to drilling holes.
      b. Avoid drilling through reinforcing
      c. Use method and equipment recommended by the manufacturer of the studs, epoxy grout, as approved by the Engineer.

3.3 PLACING PRECAST CONCRETE DECK PANELS

A. Fully brace concrete beams or steel girders prior to placing panels.

B. Place the precast concrete deck panels as shown on the plans or approved working drawings.

C. Adjust leveling devices to bring panels to the elevations shown on the Plans. Torque all leveling devices to within 15 percent of each other to provide proper distribution of panel weight to the supporting beams.

D. Prevent shifting of the precast concrete deck panels during the joining of all the deck panels.

3.4 LONGITUDINAL POST TENSIONING

A. Cure Precast panels 28-days before tensioning of any post-installed cables or rods.

B. Design and show all post-tensioning hardware and blockouts if required. Manufactured designed proprietary hardware is acceptable with the Engineer's approval.

C. Clean and remove all debris from blockouts.

D. Set final elevations after all panels are in place.

E. Grout shear keyway between panels.

F. Do not begin stressing operations until the concrete reaches the strength and age designated on the plans. Stress strands within 72 hours of panel placement and transverse joint grouting.

G. Do not post tension until the shear key grout has attained a compressive strength of 500 psi (based on manufacturer's data).

H. Install strands as shown on the plans.

I. Fully tension strand and grout all ducts according to Section 03251S.

J. Visually inspect the shear stud installation and connection details. Place structural non-shrink grout in the girder camber strips and shear stud blockouts in a continuous operation complete without voids.

3.5 INSTALLATION OF HEADED T BARS AND ANCHORS

A. Adhesive doweled anchors:
   1. Use items such as reinforcing, bar dowels, reinforcing bars, threaded rods, and bolts as shown in the plans and connected using adhesive dowel into concrete.
   2. Weld heads on bars according to the requirements of the AASHTO/AWS D1.5 2008 Bridge Welding Code.
   3. Drill, brush, clean all holes, and install all anchors according to manufacturer's published recommendations as well as all applicable specifications.
   4. Inspection is required for installation of reinforcement or threaded rods.
   5. Install adhesive anchors and test according to the epoxy anchor test schedule and as follows:
      a. Testing through the blockout is at the contractor's risk. Repair damaged beams, girders, and panels as instructed by the Engineer. Panel may be rejected if not repaired as instructed.
      b. Test 25 percent of the first 40 anchors installed and 10 percent of all anchors installed thereafter.
      c. Test the previous ten installed anchors and the next five installed anchors if any failures occur.
      d. Allow anchor adhesives to cure 48 hours prior to testing.
      e. Tension test according to ASTM E 1512.
      f. Provide minimum capacity as defined in Table 2 below.

Table 2

Epoxy Anchor Test Schedule For Anchors Installed in Hard Rock Concrete (2000 psi min. Strength)					
Reinforcing bars (f_y = 60 ksi)			**Bolts or threaded rods (f_y = 36 ksi)**		
Bar size	Minimum embedment	Tension test load (0.9fy)	Anchor diameter	Minimum embedment	Tension test load*
#4	6 inches	10800#	⅜ inch	5 inches	3384#
#5	7 inches	16700#	½ inch	7 inches	5400#
#6	9 inches	23800#	⅝ inch	8 inches	9390#
#7	10 inches	32400#	¾ inch	10 inches	13530#
#8	12 inches	42700#	⅞ inch	12 inches	18417#
#9	13 inches	54000#	1 inch	13 inches	24050#
#10	16 inches	68600#	1¼ inch	15 inches	37580#
#11	18 inches	84200#			

Notes: * allowable loads equal 1/2 test load values

3.6 PREPARATION AND INSTALLATION OF STRUCTURAL NON-SHRINK GROUT

A. Clean and remove all debris from the camber strips and blockouts prior to placement of the structural non-shrink grout.

B. Keep bonding surfaces free from laitance, dirt, dust, paint, grease, oil, rust, or any contaminant other than water.

C. Form the girder camber strips as shown on the plans after installing shear studs at the locations shown on the plans.

D. Pre-test grout material installation under field conditions in a grout pocket and camber strip mock-up prior to construction of the deck to determine grout flowability and whether subsequent cracking will occur. Include in the mock-up at least two shear connector pockets and a camber strip that is of the same configuration as the actual bridge.
   1. The Engineer will determine the required corrective action.
   2. Proceed with grouting process at the Engineer's direction.

E. Saturate surface dry (SSD) all surfaces receiving structural non-shrink grout.

F. Mix and place product following manufacturer's recommendations for preparation and installation.

G. Grout the shear stud blockouts and girder camber strips using structural non-shrink grout. Place structural non-shrink grout in the girder camber strips and shear stud blockouts in a continuous operation within a panel. Do not allow voids in the grout for the girder camber strips and shear stud blockouts.

H. Do not apply superimposed dead loads or live loads to the precast concrete deck panels until the structural non-shrink grout in the shear stud blockouts and the girder camber strips has reached a strength of 500 psi based on manufacturer's published data.

I. Fill all surface voids with non-shrink grout including lifting device blockouts and grout ports.

J. Cure structural non-shrink grout per manufacturer's recommendation.
   1. Contact the manufacturer's representative for advice on how to reduce heat such as wet curing or adding retarding admixture if the heat of hydration is excessive.

K. Repair or refund at the Department's option any bonding failures that occur during the warranty period.

L. Finish grout flush or a maximum of ⅛ inch above adjacent panels.
   1. Correct blockout and void profiles in excess of ⅛ inch higher than the adjacent panel through surface grinding
   2. Correct blockout and void profiles below the top of the adjacent panels through removal and replacement of the blockout or void.
   3. Pay for any corrections to the finish of the blockout or void at no cost to the Department.

3.7 DECK GRINDING

A. Profile grind the deck and approaches after all panels are in place, grouting is complete, and design strength is achieved according to Section 02982.

3.8 SURFACE PREPARATION

A. Prepare deck and approach slabs and place Polymer Overlay, Type 1. Refer to Section 03372.

END OF SECTION