



JOHN ELIAS BALDACCI  
GOVERNOR

STATE OF MAINE  
DEPARTMENT OF TRANSPORTATION  
16 STATE HOUSE STATION  
AUGUSTA, MAINE  
04333-0016

DAVID A. COLE  
COMMISSIONER

April 23, 2010  
Subject: **Auburn**  
Federal Project No: AC-BR-1709(201)X  
State Pin No: 017092.01  
**Amendment No. 2**

Dear Sir/Ms:

Make the following change to the bid Document:

In the Bid Book (pages 78 through 85), **REMOVE** "SPECIAL PROVISION, SECTION 509, COMPOSITE ARCH SUPERSTRUCTURE ERECTION, (Installation Only)", 8 pages dated April 2, 2010 and **REPLACE** with the attached new "SPECIAL PROVISION, SECTION 509, COMPOSITE ARCH SUPERSTRUCTURE ERECTION, (Installation Only)", 8 pages dated April 23, 2010

The following questions have been received:

**Question:** Is there a maximum torque or a specific brand/type of tool that will help to not strip the screws attaching the decking to the arches?

**Response:** A hand drill with an adjustable torque setting set to low torque is recommended.

**Question:** If the Contractor installs a turbidity curtail directly downstream will they be allowed to complete the demolition prep and place the heavy riprap and the support work associated with the arches in the wet as long as everything is cleaned up properly?

**Response:** Yes, and the work shall be performed in accordance with Special Provision 656 Temporary Soil Erosion and Water Pollution Control.

**Question:** If we supply the SCC mix as shown in the specifications, but it doesn't provide the required slump flow and/or the required strengths, who is responsible for issues of voids during filling of the arches and the strength?



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**Response:** The Contractor is responsible for completely filling the tubes. Trial batching shall be used to verify the performance of the concrete. The Contractor is responsible for providing concrete that meets the specifications.

**Question:** What is the replacement cost of a damaged tube?

**Response:** \$12,200 per arch

**Question:** What are the tolerances for manufacturing of tubes?


**Response:** Overall tolerance on arch length is +/- 1", adjacent arches will not vary by more than 1/2" at any point along the span.

**Question:** Can the mix be modified to meet strength requirements?

**Response:** Yes, see revised Special Provision 509

Consider this change and information prior to submitting your bid on April 28, 2010.

Sincerely,

A handwritten signature in dark ink, appearing to read "Scott Bickford". The signature is written in a cursive, flowing style.

Scott Bickford  
Contracts & Specifications Engineer

SPECIAL PROVISION  
SECTION 509  
COMPOSITE ARCH SUPERSTRUCTURE ERECTION  
(Installation Only)

1. DESCRIPTION

This work shall consist of installing composite arches and sheathing of the Bridge-in-a-Backpack™ system for bridge construction in accordance with these specifications and in conformity with the lines, grades, and dimensions shown on the plans or established by the Resident.

Composite arches will be designed by Advanced Infrastructure Technologies (AIT), supplied by MaineDOT, and delivered to the site. The Contractor shall coordinate with MaineDOT delivery of the arches a minimum of thirty days in advance. The arches will be available for delivery on or before July 15, 2010. Delivery must take place by October 15, 2010, at which point, if arches have not been delivered, the Contractor assumes responsibility and all expenses related to the storage of the composite arches off site. Offloading of arches shall be performed by the Contractor.

The composite arches consist of thirteen hollow carbon fiber tubes reinforced with vinyl-ester resin. The weight of each hollow composite arch is approximately 200 pounds. The geometry of the composite arches will conform to the plans and drawings. The arch vent holes and locator holes will be machined by AIT prior to delivery.

Installing the composite arches and sheathing consists of unloading arches, placing the hollow composite arches in place in abutment formwork, providing, installing, and bracing the arch filling standpipe, embedding the bases of the hollow composite arch in the abutment, attaching the fiberglass reinforced plastic sheathing to the arches, filling the arches with concrete, inspecting the filled arches for voids, and backfilling the arch structure to the lines and grades shown on the plans.

If applicable, composite headwall supply and installation is performed according to Special Provision Composite Headwall.

2. MATERIALS-COMPOSITE

- 2.1. The engineered composite material for the hollow arch tubes shall be designed by AIT to meet the specific requirements of the bridge.

2.2. Materials for composite sheathing are described in Special Provision 509  
Fiberglass Reinforced Plastic Sheathing.

### 3. MATERIALS-CONCRETE

3.1. Self-Consolidating Concrete (SCC) shall be used for the hollow composite arch structural tube concrete. The mix conform to the following requirements:

- 3.1.1. The SCC shall have a minimum compressive strength at 28 days of 6000 psi.
- 3.1.2. Minimum cementitious content shall be no less than 850 lbs per cubic yard.
- 3.1.3. The maximum water/cementitious material shall be 0.43 which is to include shrinkage compensating admixture as cementitious material.
- 3.1.4. The target air content shall be 3%, +/- 3%.
- 3.1.5. The mix design shall contain a shrinkage compensating admixture at a rate of 15% by weight of total cementitious material. Approved shrinkage compensating admixtures include:

CTS Komponent ®

CTS Cement Manufacturing

11065 Knott Ave, Suite A

Cypress, CA 90630

- 3.1.6. Coarse aggregate shall be composed of 3/8 in rounded pea stone gravel.
- 3.1.7. Fine aggregate shall be not less than 50% of the total aggregate.
- 3.1.8. The mix design shall include a viscosity modifying admixture at a dosage to be determined by the contractor's admixture representative.
- 3.1.9. The mix shall contain a hydration stabilizer dosed at a rate to ensure no hydration beginning for a minimum of 3 hours from batching.
- 3.1.10. The slump flow shall be within the range of 24 in minimum and 30 in maximum. Slump flow shall be measured for each truck, immediately prior to concrete placement, and verified every 30 minutes thereafter.

- 3.1.11. Alternative mix components proposed by the contractor must be submitted 60 days in advance of the first arch filling and be approved by the Resident.
- 3.1.12. Trial batches shall be performed a minimum of 28 days prior to use to verify Compressive Strength, Visible Stability Index, Flowability/Pumpability, and Expansive properties. Trial batch costs will be incidental to item 509.74

#### 4. EQUIPMENT

- 4.1. Concrete Pump - For placement of the SCC, a boom type concrete pump truck will be the only method allowed. The pump truck shall be capable of reaching all arches to be filled with one truck load of concrete, without moving from its initial location. The contractor shall have a backup method in place for placing SCC in any remaining unfilled portion of arch, in the event of a pump truck failure. The backup method for placing the SCC shall be approved by the Resident, and in place and capable of completing the arch filling within ten minutes of the pump truck failure.
- 4.2. Standpipe - A standpipe shall be used to introduce concrete into the arch at the base. The standpipe shall incorporate a pressure relief mechanism such that the concrete pump does not pressurize the arch beyond the head pressure of the concrete within the standpipe. Alternative filling methods proposed by the contractor must be submitted 60 days in advance of the arch embedment in the abutment and be approved by the Resident.
- 4.3. Drills for Attaching Sheathing - Drills used to attach the composite sheathing to the hollow composite arches shall be capable of being adjusted to a torque setting such that the screws do not strip out the hole.

#### 5. WRITTEN INSTALLATION PLAN

- 5.1. A written installation plan shall be submitted to the Resident within 30 days of the bid award, at least 30 days prior to arch embedment within the abutment. The written installation plan shall provide as a minimum the following information:
  - 5.1.1. Construction plan, sequence and schedule.
  - 5.1.2. Temporary storage conditions.
  - 5.1.3. Any temporary bracing plans.
  - 5.1.4. List all equipment to be used. Manufacturer performance data will be required for all pumping equipment.

- 5.1.5. The intended method and sequence of placing the concrete. This shall include a written narrative and diagrams and/or photographs as necessary so that the process will be clearly defined.
- 5.1.6. The name(s) of the responsible person in charge for the Contractor
- 5.1.7. A description of the inspection procedure for checking the arches after the concrete filling to ensure each arch has been completely filled. The description should outline the method of inspection and materials and methods to be used to fill any remaining voids.

## 6. HANDLING AND STORAGE

- 6.1. Arch Handling - Care shall be taken when handling the hollow composite arches such that no damage is caused. When moved or placed by hand, arches shall be stabilized to prevent tipping over. When moved by hoist, at least two pick points shall be used which are at least six feet apart. Each strap shall provide at least 3 inches of padded contact area.
- 6.2. Arch Storage - Hollow composite arches shall be stored to prevent damage.

## 7. DESIGN

- 7.1. The composite arch will be designed and stamped by a licensed Maine Professional Engineer.
- 7.2. The arch design loads are in accordance with the AASHTO LRFD Bridge Design Specifications 4<sup>th</sup> Edition.
- 7.3. A minimum of two feet of cover above the crown of the arch is required in the installed condition.

## 8. SHOP DRAWINGS

Shop Drawings detailing layout of fiberglass reinforced plastic sheathing on arches shall be submitted for review in accordance with Section 105.7 of the Standard Specifications.

## 9. INSTALLATION

- 9.1. The arches shall be installed in a vertical position with a maximum allowable variation of  $\pm 1/4$ " as measured by a self leveling laser tool.
- 9.2. The arch filling standpipe or other arch filling equipment shall be in place prior to placement of the abutment concrete.

- 9.3. Hollow composite arches shall be embedded within the abutment as specified in the plans.
- 9.4. Abutments shall reach a minimum compressive strength of 3500 psi prior to filling of arches with SCC concrete.
- 9.5. FRP sheathing shall be installed in accordance with the plans with drills at a torque setting such that the screws do not strip out the hole.
- 9.6. All arches shall be filled under the supervision of the Resident.
- 9.7. Each arch shall be filled with concrete in a continuous placement operation.
- 9.8. Vibration shall not be allowed when filling the arches with SCC concrete.
- 9.9. Standpipe shall not be removed until concrete has set a minimum of 8 hours.
- 9.10. The arches must be inspected for voids prior to overlay concrete slab placement.

## 10. TESTING AND INSPECTION

- 10.1. Post-Filling Void Testing - The arches shall be inspected in accordance with the written installation plan after the pumping of SCC concrete to ensure the cavity has been completely filled.
- 10.2. Testing of the arch tube SCC concrete shall be done according to the applicable provisions of Section 502 and the following:
  - Visible Stability Index shall be 1.5 Maximum
  - Slump Flow as per ASTM C1611

## 11. INSPECTION

- 11.1. The following construction activities shall be subject to oversight or inspection by the Resident. The Contractor shall notify the AIT Engineer of the schedule for each of these activities at least 3 days prior to the operation
  - 11.1.1. Initial placement of the arches in the abutment.
  - 11.1.2. Embedment of the arches in the abutment.
  - 11.1.3. Filling of the arches with SCC concrete.
  - 11.1.4. Inspection of the arches for voids
  - 11.1.5. Backfilling of the arches.

## 12. REJECTION

Arches shall be subject to rejection on account of any of the specification requirements. Individual arches may be rejected because of any of the following:

- 12.1. Dry spot in the hollow composite arch exceeding 9/16 inch in any dimension.
- 12.2. Any damage to the hollow composite arches which is in the assessment of the Resident 'severe' such that the damage compromises the ability of the member to meet the design strength.

### 13. REPAIRS

- 13.1. Any damage to the hollow composite arches which occurs after the arches are delivered to the site, and which is in the assessment of the Resident 'severe' such that the damage compromises the ability of the member to meet the design strength shall be considered un-repairable and the arch shall be replaced with an undamaged member at the Contractor's expense.
- 13.2. The only repairs permitted are those used to fill remaining voids after complete arch filling. The only allowable repair methods for filling remaining voids are those specified in the approved "Written Installation Plan".

### 14. CONSTRUCTION REQUIREMENTS

- 14.1. Prior to arch SCC concrete reaching a minimum compressive strength of 2000 psi and placement of the composite sheathing, no loading other than workmen will be allowed on the arch deck.
- 14.2. Abutments - The arches shall be embedded within the abutment to the dimensions specified on the plans. It is permissible to vibrate the concrete in the abutment around the arch such that the concrete inside the tube levels with the abutment concrete, but care must be taken to maintain the arch location within the abutment and not to damage the arch.

### 15. BACKFILLING REQUIREMENTS

- 15.1. Backfill shall be to the lines and grades shown on the plans, and shall be performed according to Section 203 in the Standard Specifications, unless modified below.
- 15.2. Arch tube SCC concrete must reach a minimum compressive strength of 2000 psi prior to backfilling of soil onto the superstructure.



- 15.3. No backfill shall be placed against any structural element until it has been approved by the Resident.
- 15.4. As a precaution against introducing unbalanced stresses in the arches, when placing backfill at no time shall the difference between the heights of fill on opposite sides of the structure exceed 24".
- 15.5. Backfill against a waterproofed surface or filter material shall be placed carefully to avoid damage to the material.
- 15.6. Mechanical tampers or approved compacting equipment shall be used to compact all backfill and embankment immediately adjacent to each side of the structure and over the top of the arches until it is covered to a minimum depth of one foot. The backfill within four feet of each side of the structure shall be placed in lifts of 6 inches or less (loose depth). Heavy compaction equipment shall not be operated in this area or over the arches until it is covered to a depth of one foot.
- 15.7. Lightweight dozers and graders may be operated over arches having one foot of compacted cover, but heavy earth moving equipment (larger than a D-4 Dozer, weighing in excess of 12 tons, or having track pressures of eight psi or greater) shall require two feet of cover. In no case shall equipment operating in excess of the design load (HL93) be permitted over the bridge unless approved by the Resident.
- 15.8. Any additional fill and subsequent excavation required to provide this minimum cover shall be made at no additional cost to the project.

## 16. METHOD OF MEASUREMENT

Composite Arch Superstructure—Installation only shall be measured as one Lump Sum of composite arch superstructure erected and accepted in conformity with the Plans and Specifications.

## 17. BASIS OF PAYMENT

The accepted quantity of Composite Arch Superstructure will be paid for at the unit price per Lump Sum complete in place, which price shall be full compensation for installing/erecting the composite arches and sheathing (sheathing supplied as Item 509.60), including arch tube concrete, standpipes, all necessary hardware, and the furnishing of all labor, materials, tools, equipment & incidentals necessary to complete the work. Placement of the overlay concrete slab is not included in this item.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
509.74 Composite Arch Superstructure Erection—Installation Only	Lump Sum