

**STATE OF NEW HAMPSHIRE**  
**DEPARTMENT OF TRANSPORTATION**

**BEDFORD**  
**16156**

October 10, 2017

**ADDENDUM NO. 2**

Bidders are hereby advised to make the following revisions to the Proposal and Plans:

1. **Bidders are hereby advised that the reference to *Culvert/Slip Line Rehabilitation*, on the Cover of the Proposal, in the Invitation to Bid, the Information Report, and the Bid Schedule (page 202), refers to Pipe Lining as referenced in the Special Provision found in attached pages 141A through 146A.**
2. **Revise**, in the *Information Report*, the *Bid Schedule* (page 205), in the *Summary of Quantities* (Sheet 6), under the Pipe Lining Notes in the *Bridge Notes* (Sheet 8), in the *Site Plan* (Sheet 9), and wherever else in the Plans and Proposal to reflect the following:

**a. Delete Item**

Item number	Description	Unit	Quantity
602.41190	Centrifugally Cast Concrete Liner for 90" CMP	LF	210

**b. Add Item**

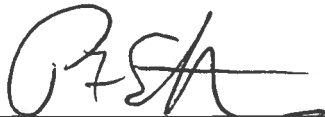
Item number	Description	Unit	Quantity
602.40090	Centrifugally Cast Liner for 90" CMP	LF	210

3. **Amend**, in the Proposal, on Page 8, in the *Prosecution of Work*, under the **Description of Work**, the last sentence to read:

The remaining pipe will then be rehabilitated by lining it with a **centrifugally cast liner**.

4. **Amend**, in the Proposal, on page 13, in the *Prosecution of Work*, under the General section of the **Construction Requirements**, Note 6 to read:
  6. For **Item 602.41190 – Centrifugally Cast Liner for 90” CMP**, the application thickness shall be a minimum of **2”**, unless the structural calculations show a need for even greater thickness. See special provisions for detailed requirements. The Contractor shall contact the Bureau of Materials and Research (Ann Scholz, 603-271-1659) two weeks prior to installing the liner.
5. **Replace**, in the Proposal, pages 141 through 146, which is the *Special Provision for Item 602.41190 – Centrifugally Cast Liner*, with attached pages 141A through 146A, which is the *Special Provision for Item 602.40090 – Centrifugally Cast Liner*.

**THE CONTRACTOR SHALL ACKNOWLEDGE**  
**THIS ADDENDUM ELECTRONICALLY**  
**AS PART OF THE ELECTRONIC BID**



Peter E. Stannas, P. E

Director of Project Development

10/10/2017

Date

October 10, 2017

**SPECIAL PROVISION**  
**DIVISION 600 – INCIDENTAL CONSTRUCTION**  
**SECTION 602 – PIPE LINING**  
**Item 602.40090 – Centrifugally Cast Liner**

**Description**

**1.1** This work shall consist of the repair of culverts by the installation of a lining, centrifugally cast in place for the waterproofing, sealing, structural reinforcement and corrosion protection of the existing arch corrugated metal pipe. The centrifugally cast liner shall extend over the specified length forming a continuous pipe within a pipe.

**1.2** Calculations for the design of the proposed liner shall be submitted for approval in accordance with Section 105 of the Standard Specifications. The design of the proposed liner shall be in accordance with the AASHTO 2014 LRFD Bridge Design Specifications seventh edition with 2016 interims, using the LRFD method, HL-93 design load, and without any contribution in strength from the existing corrugated steel culvert pipe. These calculations shall be prepared and stamped by a Professional Engineer licensed in the State of New Hampshire.

**1.3** A load rating for the liner shall be submitted for approval in accordance with Section 105 of the Standard Specifications. The bridge rating shall be in accordance with the AASHTO 2011 Manual for Bridge Evaluation second edition, with 2016 interims, using the LRFR method and HL-93 loading. The NHDOT Form 4 Bridge Capacity Summary shall be prepared and stamped by a Professional Engineer licensed in the State of NH.

**1.4** Shop plans detailing the information outlined in section 3.4 of this special provision, along with the load rating, and calculations shall be combined in one complete package and submitted for approval in accordance with section 105 of the Standard Specification.

**Materials**

**2.1 Cementitious Pipe Liner.**

**2.1.1 Cementitious Mortar.** This pipe lining material shall be a high strength, high build, abrasion resistant and corrosion resistant mortar, based on advanced cements and additives. Per ASTM C-76, in no case shall the proportion of Portland cement, blended with hydraulic cement, or a combination of Portland cement and supplementary cementing materials be less than 470 lb/yd<sup>3</sup>. In addition and due to its properties no more than 10% fly ash shall be permitted in the design. This engineered Portland cement based mortar and may contain reinforcing fibers and other additives to provide the mortar with structural properties and an adherence capability to bond the interior culvert surface.

Minimum Physical Properties		
Property	Property	Value
Compressive Strength	ASTM C39/C 39M-09a/C 109	
	1 day 28 days	2,500 psi 8,000 psi
Flexural Strength (meet either ASTM C293 OR ASTM C78)	ASTM C 293	
	7 day	600 psi
	28 days	1200 psi
	OR ASTM C 78	
	7 day	980 psi
	28 days	1340 psi
Tensile Strength	ASTM C 496	
	28 days	670 psi
Modulus of Elasticity	ASTM C469 – 02	
	1 day 28 days	3.00 X 10 <sup>6</sup> psi 5.49 X 10 <sup>6</sup> psi
Bond Strength	ASTM C882/C 882M-05	
	1 day 28 days	900 psi 1,600 psi

## 2.2 Geopolymer Pipe Liner.

**2.2.1 Geopolymer Mortar.** This engineered mortar shall be aluminum and silica based and may contain reinforcing fibers and other additives to provide the mortar with structural properties and an adherence capability to bond to itself and the interior culvert surface. This pipe lining material shall be a high strength, high build, abrasion resistant and corrosion resistant mortar.

Minimum Physical Properties		
Property	Test Method ASTM	Value
Compressive Strength	ASTM C 109	2,500 psi
	ASTM C 109 M-08	8,000 psi
Flexural Strength	ASTM C 293	1,300 psi
	or ASTM C78	or 800 psi
Modulus of Elasticity	ASTM C 469	5,490,000 psi
Bond Strength	ASTM C 882 M-05	1,700 psi

## Construction Requirements

**3.1 Centrifugally Cast Liner:** The liner material shall be applied to achieve a 2” minimum thickness. For structural plate culvert bolted connections, the cover over projecting bolts shall be a minimum of 1”. Bolt projections may be cut back to the face of the nuts using an abrasive disk or saw blade, in no case shall the nuts be removed, or the integrity of the bolted connections be compromised. The 2” minimum thickness shall be measured from the I.D. of the pipe (top of the inward corrugation’s crest). For non-circular shapes, the Contractor shall demonstrate that the lining machine is capable of applying the material at a uniform thickness and density. The bottom portion of the pipe liner, shall be roughened for a height of 24” above the pipe invert, and shall have a Manning’s number of 0.018; the upper portion of the liner shall have a Manning’s number of 0.014.

**3.1.1** Prior to installing the pipe liner, the existing culvert shall be clear of obstructions, such as: solids/debris, dropped joints, roots, protruding lateral or collapsed pipe or loosened sections of the previously installed reinforced concrete invert repair that will prevent installation. After the entire pipe is free from all obstructions, the interior surface of the pipe shall be cleaned with a high-pressure water-blast, sufficient to remove all laitance and loose material and flush debris from the pipe. Rusted portions of the corrugated steel pipe shall be removed or sand blasted to white metal and coated with an approved epoxy rust protector, per the manufacturer’s recommendations.

**3.1.2** Item 520.32 shall be used to grout any voids found in the backfill material surrounding the existing culvert, prior to installing the concrete liner. See special provisions for detailed requirements.

**3.1.3** Check equipment used to mix and pump the material. Prior to inserting delivery hoses into the culvert, pump and recirculate the material until the temperature specified by the manufacturer is reached.

**3.1.4** Areas of water seepage shall be sealed off by an approved method. Pools of water shall be removed; however, a dry surface is not required. The Contractor shall patch holes and fill voids in and around existing pipe as directed by the Engineer. Before the initiation of lining, visually test the material by test spraying onto a test card.

**3.1.5** Mixing and application of materials shall be in accordance with the Manufacturer’s specifications.

**3.1.6 Application.** The Contractor shall position the bi-directional rotating casting applicator within the culvert pipe as required by the Manufacturer and commence pumping the mortar. As the mortar begins to be centrifugally cast evenly around the interior, the Contractor shall retrieve the applicator head at the best speed for applying the thickness that has been specified. If the mortar flow is interrupted for any reason, the Contractor shall arrest the retrieval of the applicator head until the mortar flow is restored. Throughout the application process, the Contractor shall verify the thickness using appropriate methods and equipment.

**3.1.7 Surface Finish.** Troweling of the newly applied mortar lining shall be done mechanically with either rotating trowels or a conical drag trowel attached to the lining machine. Hand place mortar and trowel in places where machine lining is impractical (such as sharp bends and areas closely adjacent to valves). Refer to section 3.1 roughness requirements.

**3.1.8 Hot Weather Application.** The Contractor shall not apply the mortars when the ambient air and/or surface temperature of the culvert pipe is 100°F or higher.

**3.1.9 Cold Weather Application.** The Contractor shall not apply the mortars when ambient air temperatures are expected to fall below 45°F within 72 hours of placement. Both the ambient air and substrate temperatures must be at least 45°F at the time of placement

**3.1.10 Curing.** Curing of liner shall be per manufacturer's recommendation. The Contractor shall use an ASTM C309 conforming curing compound for cementitious mortar products.

**3.1.11** The lined pipe shall be thoroughly rinsed with clean water. Temporary erosion control measure shall remain in place until the pipe has cured and is reinstated.

## **3.2 General Installation.**

**3.2.1** Prior to entering access areas and performing inspection or cleaning operations, test the atmosphere in the insertion pits to determine the presence of toxic or flammable vapors, or the lack of oxygen in accordance with local, state, or Federal safety regulations.

**3.2.2** Inspect the existing culvert to determine the location of any conditions that may hinder proper insertion of the cured-in-place lining liner, and clear obstructions. If obstructions cannot be cleared, point repair excavation shall be used to remove and repair the obstruction.

**3.2.3** A minimum of nine test cubes of the mortar material shall be taken randomly per day as directed by the Engineer to verify strengths at 24 hours, and 28 days. Thickness can be verified with a wet gage at any random point of the new interior surface. Any areas found to be thinner than the specified minimum shall immediately receive additional material. Visual inspection shall verify a leak-free, uniform appearance.

**3.2.4** Existing Pipe damage requiring repairs, as determined and directed by the Engineer, will be paid for under Item 1002.1 –Repairs or Replacements As Needed – Bridge Structures.

**3.2.5** The warranty requirements for all liner applications shall be 2 years from time of completion. During this period, defects discovered shall be repaired at the contractor's expense.

**3.3 Centrifugally Cast Liner Contractor Qualifications.** The Contractor conducting the centrifugally cast lining installation shall be trained and certified to operate the installation equipment and shall have at least five (5) years' experience in similar installations. Minimum requirements shall be the experience of at least 6 installations in a similar nature to that specified herein. Liner installation operations shall be performed under the constant direction of a qualified supervisor who shall be on site and be in responsible charge throughout the operation. The

supervisor shall have supervised installations on at least five (5) previous projects of similar size, type, and complexity.

**3.4 Submittals (refer to requirements of section 1.2, 1.3, and 1.4).** The Contractor shall supply the following to the Engineer:

**3.4.1 Qualifications of the Centrifugally Cast Pipe Lining Contractor.**

- a. Name, business, address and telephone of the Centrifugally Cast Pipe Lining Contractor.
- b. Experience in successfully constructing pipelines by the method proposed to be used to install the concrete liner for this project.
- c. List of similar projects within the last five (5) years including the name of contact person and telephone number.
- d. Certification of workmen training.
- e. Name(s) of all supervisory personnel to be directly involved with the project.
- f. The pipe lining contractor shall sign and date the information provided and certify that to the extent of his knowledge, the information is true and accurate, and that the supervisory personnel for the installation operations will be directly involved with this project. Substitution of personnel and/or methods will not be allowed without the written authorization of the Engineer.

**3.4.2 Construction Procedures.**

- a. Written description of the construction method and equipment to be used, and locations required for equipment and material access, and storage.
- b. Written description for the application of the centrifugally applied lining material.

**3.4.3 Contingency Plans.** The Contractor shall develop and submit written contingency plans for handling problem scenarios that may be encountered. The list of potential scenarios includes, but is not limited to:

- a. Major mechanical breakdown.
- b. Leakage.
- c. Unexpected high water/storm events.

**3.4.4 Equipment.**

- a. Written description and documentation of the equipment to be used. All equipment needed for installation of the liner shall be in good condition and capable of completing the project without delays.

**3.4.5 Materials.**

- a. Written description and documentation of the materials and other products to be used.

**Method of Measurement**

**4.1** Pipe lining will be measured by the linear foot to the nearest 0.5 of a foot complete in place.

### **Basis of Payment**

**5.1** The accepted quantities of pipe lining will be paid for at the contract unit price per linear foot of the kind, type, and size specified complete in place, including inspection, cleaning and repair of existing pipe; set-up and installation; and any materials and labor necessary for complete installation not paid for separately under other bid items.

#### **Pay item and units:**

602.40090	Centrifugally Cast Liner for 90" CMP	LF
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