

UNDERWATER GROUT

**\*\*From Mount Holly STRB1501  
Ferrisburgh STRB1502**

xx. DESCRIPTION. This work shall involve installing a structural repair liner of on the bridge as shown on the plans and as directed by the Engineer, with prepackaged Portland Cement Underwater Grout as shown on the drawings.

(a) Definitions.

- (1) Underwater Grout: is defined as a prepackaged single component Portland cement containing aggregates with anti washout components for placement underwater by the tremie method.
- (2) Tremie Method: is defined as the placement of grout by being pumped underwater from the bottom of the forms to the top of the forms by the use of a concrete pump.

xx. APPLICABLE STANDARDS AND SPECIFICATIONS. The most recent versions of the cited standards and specifications shall be used to govern the quality of work and materials.

ASTM A 615/AASHTO M 31M/M31      Standards      Specification      for  
Deformed  
and plain Carbon Steel Bars for  
Concrete Reinforcement

ASTM 882      Test Method for Bond Strength of  
Epoxy Resin Systems used with  
concrete

ASTM C 31      Practice and Curing of Concrete  
Test Specimens in the field

M A36      Standards      Specification      for  
Structural steel

ASTM C42      Test Methods for obtaining and  
testing Drilled Cores and Sawed  
Beams in Concrete

xx. MATERIALS. The prepackaged materials used for this work shall be adequate with a demonstrated successful track record, for the purpose intended and under the conditions normally expected in work of this type. All materials for the project shall be provided by the same manufacturer and shall conform to the following requirements:

- (a) The contractor shall provide a prepackaged single component, specially formulated combination of Portland cement with aggregates and anti-washout additives as manufactured by US

Concrete Products of Timonium MD or approved equal with the following properties:

Compressive strength ASTM C 109:

@ 1 day	500 psi
@ 7 days	4,000 psi
@ 28 days	6,000 psi

Flexural Strength ASTM C-348: @ 28 days 1,000 psi  
Bond Strength ASTM C-882 1,800 psi  
Freeze Thaw Resistance ASTM C666 99.2%@300 cycles

- (b) Cement shall be a Type II Portland Cement which shall be micro Silica enhanced.
- (c) Air content shall be 7 % (+/- 1.5 %)
- (d) Slump shall be 6" (+/- 1")
- (e) Anti-washout additives shall be proportioned to the mix at the place of manufacture

xx. GENERAL FABRICATION REQUIREMENTS.

- (a) General. Materials and installation thereof shall meet the requirements of local, state, or Federal codes, regulations, and ordinances having jurisdiction.
- (b) Quality Control. The contractor shall furnish the services of a technical field representative from the grout manufacturer, during project startup, to ensure the proper application of the underwater grout.
- (c) Contractor Qualifications.
  - (1) Installation shall be by a contractor that has experience with placing concrete by the tremie method.

Testing and Inspection Services: Contractor shall provide quality control and inspection services for the scope of work defined in this specification.

- (d) Qualifications of Personnel.
  - (1) The contractor shall have a minimum of four years experience in the application of cast-in-place concrete restoration. The contractor must present a minimum of five (5) concrete restoration projects for verification of work experience.
  - (2) Foremen before employment on the work shall satisfy the Engineer that each has done satisfactorily work in similar capacities elsewhere for a sufficient period of time to be fully qualified to properly perform the work in accordance

with the requirements indicated. Foremen shall have had at least three years experience.

xx. SUBMITTALS.

- (a) Submit manufacturer's product data describing product characteristics and components.
- (b) Submit manufacturer's recommended instructions for application of products, including application equipment.
- (c) With properties listed herein, submit certificates of compliance from manufacturer and /or regulatory or testing agencies.
- (d) Shop drawings.
  - (1) Submit details and procedure for installing forms. Provide procedure for mixing, pumping and placement of material.
  - (2) Submit method of diverting water from forms.
- (e) Resume of experience for contractor and foreman to demonstrate compliance with the qualification requirements.

xx. TESTING.

- (a) Methods of Samplings and Testing.
  - (1) ASTM C39-14 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - (2) ASTM C31-12 Standard Practice for Making and curing concrete Test specimens in the field.
- (b) Control Testing.
  - (1) From each work shift of placing underwater grout by each crew a set of size 4"x 8" test cylinders shall be taken. Concrete cylinders shall be fabricated and cured per ASTM C31 then provided to the Engineer for testing. Compression tests shall be performed at 3, 7, and 28 days in conformance to ASTM C39.

xx. Execution of Work.

- (a) Delivery, storage and Handling.
  - (1) Deliver materials to the site in original packages or Containers bearing the manufacturer's labels and identification.
  - (2) Store and handle materials to prevent inclusion of foreign matter and water and store at manufacturer's recommended temperatures and humidity. The storage temperature for the material shall be between 50-90 degrees F.
- (b) Job Conditions.

- (1) Notify the Engineer at least 24 hours in advance of Schedule placement of underwater grout.
  - (2) Environmental Conditions: Do not apply material if ambient temperature will fall below 40 degrees F, Within 24 hours of application.
  - (3) The areas to be in contact with the underwater grout shall have had all loose unsound rock or undermined concrete channel paving removed.
- (c) Safety. Take all precautions and safety measures for applicators recommended by product manufacturer, or as required by regulatory agencies.
- (1) Product contains cement and additives which may, in certain cases cause skin irritation. Cleanliness is required. In case of eye contact, consult nearest doctor. Refer to manufacturer's product literature for complete cautionary data.
- (d) Equipment.
- (1) Mixing Equipment.
    - a. The mixing equipment will be by the use of a paddle mixer as approved by the manufacturer and shall have the ability to mix the material to the proper moisture content without exceeding the manufacturer's recommended volume of water.
    - b. Use a rotary stator pump capable of introducing Materials to the delivery hose at a uniform rate Hoses shall be made for pumping grout or Portland cement concrete, with pure gun rubber tube, good flexibility and high resistance to Kinking.
- (e) Preparation of Surfaces.
- (1) Treatment of Surfaces.
    - a. Areas to be grouted shall be clean, sound and free of moss or vegetation.
    - b. The contractor shall place all reinforcing Steel as shown on the drawings and secure the Rebar to the stone arch with pins or other means acceptable to the Engineer.
  - (2) Placement.
    - a. Once the existing surface of the concrete Substrate is properly cleaned and forms placed and sandbagging or other means to limit the flow of water into the forms the placement of the underwater grout shall start at upstream end of the forms and continue until

the forms are completely filled with the underwater grout.

- b. Install drilled in rock anchors as shown on the Drawings and use an underwater epoxy grout to grout in anchors dowels.
  - c. Intermediate construction joints are allowed, However if intermediate forms are installed the Contractor shall place four steel dowels across the cold joint.
- (f) Mixing. Mechanically Mix with a heavy duty paddle mixer as recommended by the mortar manufacturer.
- (g) Curing. Since the grout will be placed underwater the need for a curing compound is not required. However at locations where the grout is above the water level the top surface of the grout shall be cured with a curing compound.
- (h) Clean up.
- (1) Remove fresh mortar or concrete from tools and mixing equipment with water. Cured material can only be removed mechanically.
  - (2) The steel coating and any spilled underwater grout shall be removed immediately following each application.
  - (3) The contractor shall take all precautions necessary to prevent the accumulation of underwater grout outside of the locations identified on the drawings.
  - (4) At the end of each work shift the work area shall be left in a neat and clean condition, without evidence of spillover into adjacent areas. Final cleanup shall be performed by mechanical means if required.
- xx. METHOD OF MEASUREMENT. The quantities of Special Provision (underwater grout) to be measured for payment will be the number of cubic meters (cubic foot) installed in the complete and accepted work, measured within the limits shown on the Plans or as directed by the Engineer.
- xx. BASIS OF PAYMENT. The accepted quantities of Special Provision (underwater grout) will be paid for at the Contract unit price per cubic foot. Payment will be full compensation for furnishing, transporting, handling, and placing the material specified, including any temporary scaffolding or incidentals required for the grout application, providing and placement of curing compound, services of the manufacturer's representative and cleanup, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

New reinforcing bars and welded wire fabric will be paid for by weight per pound of steel installed complete in place as shown on the contract drawings under contract item 507.11.

Drilled in anchor rebar will be measured complete in place including all incidentals required to grout drill in the anchor and grout the anchor into rock. The drilled in anchor will be paid for at the contract unit price under contract item 507.16.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.605 Special Provision (Underwater Grout)	Cubic Foot