INTEGRAL PILE JACKETS.
(REV 11-16-11) (FA 12-8-11) (1-15)

The following new Section is added after Section 455:

SECTION 457
INTEGRAL PILE JACKETS

457-1 Description.
Furnish, fabricate and install an integral pile jacket in accordance with the Contract Documents.

457-2 Materials.

457-2.1 Stay-In-Place Forms: Use forms composed of a durable, inert, corrosion resistant material with an interlocking joint along one or two sides that permits the form to be assembled and sealed in place around the pile. Fabricate the forms from fiberglass and polyester resins, having a minimum thickness of 1/8 inches with a minimum thickness at the corners of 3/16 inches. Ensure the form is capable of maintaining its original shape without additional support or damage when placed around a pile. Ensure the inside face of the form has no bond inhibiting agents in contact with the filler material. Provide the forms with bonded or bolted-on, non-metallic standoffs to maintain the forms in the required positions. Sandblast or score the inside surface of the forms with an abrasive material to provide a rough surface texture. Equip the forms with a compressible sealing strip at the bottom which will effectively seal the annular space between the pile and the form. Use non-metallic hardware for pumping ports when these are provided. Fabricate the pile jacket form in a workmanlike manner and have it inspected and approved by the Engineer prior to placement on piles. Remove from the project any pile jacket form that has been rejected.

The forms shall meet the following physical property requirements of Table 1:

<table>
<thead>
<tr>
<th>Table 1: Physical Requirements of Stay-In-Place Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Absorption (ASTM D 570)</td>
</tr>
<tr>
<td>Ultimate Tensile Strength (ASTM D 638)*</td>
</tr>
<tr>
<td>Flexural Strength (ASTM D 790)*</td>
</tr>
<tr>
<td>Modulus of Elasticity (ASTM D 790)</td>
</tr>
<tr>
<td>IZOD Impact (ASTM D 256)</td>
</tr>
<tr>
<td>Barcol Hardness (ASTM D 2583)</td>
</tr>
</tbody>
</table>

Color: Similar to Federal Color Standard No. 595, Table VII, Shade No. 36622. The color must be integral in the form gel coat.

* On original specimens whose flat surfaces are not machined to disturb the fiberglass.

457-2.2 Anode Material: Use expanded mesh anodes pre-installed inside the form by the manufacturer when cathodic protection integral pile jackets are specified. Use anode type and configuration shown in the Contract Documents. If galvanic anodes are used, place the nodes in direct contact with the inside face of the form.

457-2.3 Fillers: Use portland cement grout fillers for non-structural jackets and concrete fillers for structural jackets unless otherwise specified in the Contract Documents.
**457-2.3.1 Portland Cement Grout:** Use a mix design of portland cement, fine aggregate, water and an admixture containing a minimum of 940 pounds of cementitious material per cubic yard. Up to 30%, by weight of cement, may be replaced by fly ash for standard pile jackets. Do not use fly ash, slag, or silica fume for cathodic protection jackets.

- Use silica sand fine aggregate meeting the requirements of Section 902.
- Use portland cement meeting the requirements of Section 921.
- Use admixtures meeting the requirements of Section 924, ASHTO M194, Types A and D.
- Use air-entraining admixtures meeting the requirements of Section 924 and containing no chlorides or other salts corrosive to metals.
- Use fly ash meeting the requirements of Section 929, ASTM C618, Type F, except that loss on ignition shall not exceed 4%.
- Provide a grout filler mix with a minimum compressive strength of 5,000 psi at 28 days and a slump of 7 inches to 9 inches. Submit the design mix to the Engineer for approval by the Department before placing any grout filler.

**457-2.3.2 Class IV Concrete:** Use Class IV Concrete meeting the requirements of Section 346 with an adjusted slump of 7 inches to 9 inches. Reduced size coarse aggregate may be used as approved by the Engineer. Do not use fly ash, slag, or silica fume for cathodic protection jackets.

Submit the design mix to the Engineer for approval by the Department before placing any concrete filler.

**457-2.3.3 Special:** When required, furnish special fillers in accordance with the Contract Documents. Provide test results and documentation that demonstrate the material meets the requirements for the project. Use materials meeting the requirements of 930-7 when cementitious pre-bagged fillers are specified.

**457-2.3.4 Chlorides:** Total amount of chlorides for jacket fillers shall not exceed 0.4 pounds per cubic yard of filler. Total amount of chloride will be tested at a random basis as directed by the Engineer.

**457-2.4 Water:** Use water that meets the requirements of Section 923 for all filler mixing. Use potable water for cleaning, rinsing, or any other application that requires direct contact with the piles.

**457-2.5 Reinforcing Steel:** Use reinforcing steel meeting the requirements of Section 415 for all structural jackets.

**457-2.6 Materials Certification and Testing.**

- **457-2.6.1 Certification:** For materials other than those for portland cement grout and Class IV concrete, provide a certificate to the Engineer certifying that the materials furnished meet all the requirements of this Section and conform in all respects to the materials tested. Attach copies of current test reports to the certificate.
- Provide certified test results of the chemical composition of the anode and provide manufacturer certification stating that the dimensions and physical characteristics of the anode meet the requirements of the Contract Documents when cathodic protection jackets are specified.

**457-2.6.2 Testing:** No test report for tests made more than two years prior to shipment will be accepted for the form material.
Test materials for portland cement grout and Class IV concrete as required in Section 346 for approved design mixes. Perform sampling and testing using Quality Control technicians meeting the requirements of Section 105.

Test properties of materials for other cement based fillers allowed under 457-2.3.3 same as required for the Department approved design mixes. Test the materials at a frequency of one set of tests per load of the mixer. For each set of tests, cast three 4 inch by 8 inch cylinders for compressive strength testing at the required test date. The Engineer may adjust the frequency of testing based on consistency of the mixes. Conduct a field verification mix prior to commencing the jacket installation. Cure samples of cement based materials in accordance with ASTM C31.

Hardened concrete or grout will be accepted on the basis of strength test results as defined in this Section. Test the laboratory cured samples for compressive strength at 28 days in a laboratory meeting and maintaining at all times the qualification requirements listed in 105-6.

457-3 Construction.

457-3.1 Shop Drawings: Submit shop drawings and obtain approval prior to field installation. Provide shop drawings showing locations of standoff spacers, method of fastening jacket form to piling, method of sealing the form after installation, and method for bracing during placement of filler. Include details of access holes, fiberglass caps, and methods for placing the filler and cutting and sealing the pumping ports.

457-3.2 Surface Preparation: Remove all cracked or delaminated concrete and excavate to a depth of 3/4 inches to 1 inch behind the exposed reinforcement. Limit the size of chipping hammers to 20 pounds unless otherwise approved by the Engineer. Thoroughly clean all pile surfaces that the jackets will cover. Remove all oil, grease, dirt, broken concrete, marine growth and any other deleterious material that would prevent proper bonding. Sandblast all exposed reinforcing steel to SSPC-SP10, near white, per the Society of Protective Coatings, to remove all rust and scale before installing the pile jacket. Water blast or mechanically clean reinforcing steel exposed under water by methods and with equipment approved by the Engineer. Clean existing concrete surfaces by sandblasting, wet blasting, wire brushing, water laser, or other methods approved by the Engineer which will yield an equivalent result. Do not place the form until the surface preparation has been approved by the Engineer.

457-3.3 Cathodic Protection: Provide connection to the reinforcement for cathodic protection integral pile jackets inside the jacket limits unless otherwise specified in the Contract Documents. Use connection methods and materials in accordance with the Contract Documents.

457-3.4 Form Placement: Place the fiberglass form in position around the pile; secure and seal the interlocking joints, and seal the bottom of the form against the pile surface with the compressible seal and an epoxy mastic suitable for underwater application. Adjust stand-offs as necessary to prevent misalignment and install temporary hard backing to prevent deformation. Place a temporary plastic wrap around the form prior to placement of the hardbacking to protect the gel coat.

457-3.5 Filler Placement: Wet to saturation the surface of the pile immediately prior to placing the filler. Place the filler in one continuous pour at no more than 72 hours after surface preparation. Fill the annulus between the pile and pile jacket form following the jacket manufacturer’s instructions and the Contract Documents. Do not drop filler material into forms.
higher than five feet or into forms containing water. Prevent contamination of the filler during placement and provide internal or external vibration to ensure proper consolidation.

Cure filler for a minimum of 96 hours before removing any external bracing. Remove any filler or other extraneous material from the exterior surface of the form and clean the form without damaging the fiberglass or gel coat resin. Cut pumping ports flush with the surface of the jacket and seal opening with epoxy.

457-4 Method of Measurement.

The quantities to be paid for under this Section will be the total feet of integral pile jacket furnished, installed, completed and accepted. Measure length from bottom of the form to top of the form.

457-5 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section. No separate payment will be made for reinforcing steel or filler material. Include payment for anode material and anode connection accessories in the price per foot for cathodic protection integral pile jackets.

Payment will be made under:

- Item No. 457-1- Standard Integral Pile Jacket - per foot.
- Item No. 457-2- Cathodic Protection Integral Pile Jacket – per foot
TECHNICAL SPECIAL PROVISIONS
FOR
CONCRETE REPAIRS
(T401)

New Pile Jackets for Main Street Bridge
Bridge No. 794004

Prepared by: Steven Shaup, P.L. #52099
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Consultants
2400 East Commercial Blvd., Suite 1000
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Certificate of Authorization #7503

Date: June 22, 2015
T401 – CONCRETE REPAIRS

T401-1. DESCRIPTION
   T401-1.1. General
   Repair all spalls, delaminations and poor repairs in the concrete piles of Bridge No. 794004 as specified in the plans. Remove unsound and delaminated material prior to performing any repairs.

T401-2. MATERIALS
   T401-2.1. General
   All materials must be supplied by the same manufacturer, when possible, and be approved by the Engineer. All inhibitors and repair material shall be compatible and applied in accordance with the manufacturer’s recommendations and this Technical Special Provision.
   T401-2.2. Welded Wire Fabric
   Use galvanized welded wire fabric conforming to ASTM A185.
   T401-2.3. Patching Material
   Use a pre-packaged latex modified mortar or a polymer-modified, silica-fume enhanced repair material designed for the specific application that meets the requirements of FDOT Specification 930.
   T401-2.4. Reinforcing Steel
   Meet the requirements of the FDOT Specification 415.
   T401-2.5. Bonding Agent
   Apply a surface-applied bonding agent containing corrosion inhibitors prior to application of repair material.

T401-3. REPAIR METHODS
   T401-3.1. General
   Locate and inspect all deteriorated areas in the culvert and note all areas proposed to be repaired. Sound test the areas and the surrounding concrete surfaces to determine the actual dimensions of the areas to be repaired.
   Mark or otherwise delineate the limits of proposed demolition on the concrete surface. The limits shall be verified, modified as necessary, and recorded by the Contractor. Do not perform concrete demolition/removal prior to the County’s approval and recording of the removal limits. Exercise caution to avoid damaging the existing reinforcing steel. Clean the exposed concrete surfaces and any reinforcing steel to remove all bond-inhibiting materials and take necessary precautions to avoid damaging the surrounding area.
   Completely remove all cracked or unsound concrete and all existing metalizing. When Class 1 (0 to 1/64-inch) cracks are encountered, notify the County for inspection. Concrete with Class 1 cracks but solid sounded may be left in place if directed by the County.
   Remove concrete from around oxidized reinforcing steel. Remove concrete using a max. 15 pound chipping hammer and a max. 4 pound scaling hammer. Extend the perimeter area to be square cut to expose reinforcing steel a minimum of 6 inches from the oxidized portion. Square cut the perimeter of areas to have concrete removed using a 3/4 inch minimum depth sawcut. Undercut to provide 3/4 inch to 1 inch clearance between exposed reinforcing steel and
surrounding concrete to assure full encasement and bond with the new concrete repair material. All repair areas shall have square edges in as simple a configuration as possible and be roughened to manufacturer’s guidelines. Remove all deteriorated material within the sawcut limits.

T401-3.1.1. Placement of Forms
Placement of forms and pouring shall be completed as soon as practical after mediablasting and before any other contamination occurs.

T401-3.1.2. Surface Preparation
All surfaces to be repaired must be clean, sound and free of surface moisture, oil and grease. Remove dust, residue, marine growth, laitance, curing compounds, waxes, impregnation, foreign particles and other bond inhibiting materials from the surface by mediablasting. Chip off areas that have been saturated with oil or grease to sound, non-contaminated concrete. Areas that may trap air are to be trimmed or vented. If areas become contaminated after initial cleaning, they must be re-cleaned prior to applying the repair material.

T401-3.2. Reinforcement
Remove the concrete adjacent to the bar from 3/4 to 1-inch depth to permit bond to the entire periphery of the exposed bar. If unsound concrete goes to a depth of two inches or more beyond, stop for direction from the County. Prevent cutting or damaging of exposed reinforcing steel. Clean all reinforcing bars exposed after material removal to SSPC SP-10.

Use extreme caution to not damage existing steel reinforcement. If the existing reinforcement is damaged, notify the County for additional instructions on the applicable repair. Remaining bars must display acceptable bonding with existing concrete. If bonding is lost or damaged, additional steel shall be exposed until bonded, undamaged steel is reached. Any existing reinforcing steel damaged by the Contractor’s actions in the process of removing unsound concrete or cleaning reinforcing steel shall be repaired to the satisfaction of the County at the Contractor’s expense. If it is determined that the damage has adversely affected the capacity of the concrete component, the contractor shall provide a load rating signed and sealed by an Engineer registered in the State of Florida at no cost to the County.

Splice bars that have lost 25% or more of their cross-sectional area over a 1-foot in length, or as determined by the Engineer. When using new bars spliced in place, maintain the original cover, with the minimum lap required shall be 48 times the bar diameter and, if necessary, provide additional chipping. Dual bars of equivalent or greater section may be used as approved by the Engineer.

Welded wire fabric shall be used on repairs with depths exceeding 2-inches. The welded wire fabric placed in repairs without exposed existing reinforcing shall have a minimum ½-inch depth adjacent to the wires to permit bond to the entire periphery of the wire. Place the welded wire fabric after the existing rebar has been cleaned. Tie the wire fabric at regular intervals, vertically and horizontally, not to exceed 8-inches, or as directed by the County. Field bend the welded wire fabric to conform with any changes in the concrete surface profile.

T401-3.3. Bonding Agent
Apply an approved bonding agent containing corrosion inhibitors per manufacturer’s recommendations immediately prior to applying patching material. County must approve bonding agent application rate and methods prior to use.
T401-3.4. Material
Spalled or damaged areas of concrete shall be repaired using an approved material mixed, applied and cured in strict accordance with the manufacturer’s specifications. The County shall approve the specific material, to ensure that the application is appropriate. Match repair material surface to surrounding concrete surfaces. Provide “V”-groove construction joints, drip notches, or any other features required to match the existing. Forming may be required at larger areas. Temporary shoring may be required as temporary supports.

Repairs shall be performed to ensure the approved repair mortar is carefully worked into the repair area to achieve complete contact between the repair mortar and the substrate concrete.

T401-4. QUALITY CONTROL
Include the work under this Technical Special Provision in the Contractor Quality Control General Requirements set forth in FDOT Specification 105.

T401-5. METHOD OF MEASUREMENT
The quantity of concrete restoration to be paid for under this Technical Special Provision shall be the volume in cubic feet of repair material authorized, satisfactorily placed and accepted. The method utilized in determining the volume will be the surface area in square feet multiplied by the average depth of such areas.

T401-6. BASIS OF PAYMENT
Price and payment will be full compensation for all work in this Technical Special Provision and any incidental items necessary to complete the work.

Payment will be made under:
  Pay Item Number 401-70  Restore Spalled Areas – per cubic foot
TECHNICAL SPECIAL PROVISION
FOR
CATHODIC PROTECTION
(T457)

New Pile Jackets for Main Street Bridge
Bridge No. 794004

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Certificate of Authorization #7503

Date: June 22, 2015
T457 CATHODIC PROTECTION

T457-1 Description. The work under this Technical Special Provision includes the installation of galvanic cathodic protection (CP) pile jackets with a zinc mesh anode.

T457-2 Qualifications: Provide a CP specialist to supervise the overall installation of the CP systems and conduct the tests indicated in the contract documents. CP specialist qualifications shall be submitted to the County for approval. This individual shall be under contract with the contractor and should be involved with the coordination of work. The individual shall have a minimum 10 years of experience in the field and be an independent specialist with a National Association of Corrosion Engineers (NACE) cathodic protection specialist certification. The CP specialist shall provide services which include, but are not limited to, the following:

1. Conduct strand continuity tests and certify results.
2. Verify and certify effectiveness of continuity bonds.
3. Verify and certify negative connections.
4. Certify overall installation of each pile CP system.
5. Energize each CP pile jacket.
6. Certify all test results

T457-3 Quality Control: A quality control plan that all work must comply with shall be submitted by the specialist to the County for approval prior to commencing the installation work for the CP systems or CP system components.

Work under this Technical Special Provision shall be included in the Contractor’s Quality Control Plan. As a minimum include in the quality control plan methods of measuring electrical continuity, voltages, currents, and rebar potentials. Also include frequency of intended quality assurance visits and time to discuss quality control and method of construction with Contractor’s and County personnel.

T457-4 Cathodic Protection Pile Jacket Anode Material

T457-4.1 Description.

T457-4.1.1 Zinc Mesh Anode: The CP system uses zinc mesh anode. The anode shall be suitable for encapsulation in a sand-cement grout or concrete filler as per FDOT Specification 457.

T457-4.1.2 Cathodic Protection System Acceptance: Preliminary acceptance of systems shall be based on voltage potential measurement tests obtained between the anode and the reinforcing steel to verify that no electrical shorts exist. Any jackets shorted to the rebar cage, welded wire fabric, or pile reinforcement shall be removed and replaced at no cost to the County.

T457-4.2 Materials and Testing.

T457-4.2.1 Zinc Mesh: The zinc mesh shall conform to ASTM B-69 with the following composition:

<table>
<thead>
<tr>
<th>Element</th>
<th>Maximum Weight Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead (Pb)</td>
<td>0.001%</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>0.001%</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>0.003%</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>0.7-0.9%</td>
</tr>
<tr>
<td>Aluminum (Al)</td>
<td>0.001%</td>
</tr>
<tr>
<td>Titanium (Ti)</td>
<td>0.001%</td>
</tr>
</tbody>
</table>
Magnesium (Mg) 0.001% weight maximum
Nickel (Ni) 0.003% weight maximum
Tin (Sn) 0.003% weight maximum
Zinc (Zn) balance

The zinc mesh shall have the following physical properties:
  Electrical conductivity 28% minimum
  Solid Zinc density 0.26 pounds per cubic inch
  Weight of expanded mesh 1.6 pounds per square foot
  Open area of expanded mesh 53% (density)
  Solid Zinc sheet thickness 3/32 inches

The zinc mesh shall have the following geometrics:
  0.500 inch hex pattern
  0.125 inch strand width in short direction
  0.500 inch strand width in long direction
  0.320 inch short opening
  0.750 inch long opening

**T457-4.2.2 Bulk Zinc Anode:** A 48-50 pound bulk zinc anode is required for the CP system for the jackets. The bulk zinc anode shall conform to ASTM B-418 for a Type I anode and shall be 99% pure zinc with a steel strap core. The steel strap shall be hot dip galvanized with a minimum zinc thickness of 0.005 inch. A 3/4 inch diameter hole shall be predrilled at each end of the steel strap prior to galvanizing.

  The bulk zinc anode shall be clamped to the pile using a two inch galvanized steel channel with the flanged side placed against the concrete surface and using two 5/8 inch diameter hot dip galvanized carriage bolts which extend to the anode.

  The anode shall be connected to the reinforcing steel as shown in the plans. Minor excavation (up to 2 feet) may be required to place the bulk zinc anode (or address a deficiency). No jetting is permitted, only hand excavation will be allowed. The mudline must be returned to original condition.

**T457-4.3 Construction**

**T457-4.3.1 Anode Configuration:** Resistance weld one end of each of two No. 10 AWG copper strand wires with THHN insulation to the spiral that was exposed during the continuity test and one end each of another two wires to the rebar cage or welded wire fabric. The connections shall be coated with two coats of 100% solids non-conductive epoxy such that no wire or weld will be in contact with concrete or patching material. Route the copper wire in conduit so that the free end of the wire terminates near the proposed junction box for fastening later. Resistance weld one end of a No. 6 AWG copper strand wire with HMWPE insulation to the steel bar at the bulk zinc anode. Welding of the connection wire to the bulk anode should be performed prior to anode installation. Attach the bulk zinc anode to the pile. Route the copper cable in the corner of the jacket between the mesh and the form so that the free end of the cable terminates near the proposed junction box for fastening later.

  Perform surface preparation and jacket installation as per FDOT Specification 457. The zinc mesh/fiberglass jacket halves shall be placed around the pile no later than 18 hours after the water wash. After jacket halves have been placed, route the two copper wires coming
out of the jacket in conduit so that the free end of the cable terminates near the proposed junction box for fastening later.

The free ends of the copper wires/cables shall be connected in the junction box as shown. The following cables shall be present:

- 2 spiral (negative) (cathode)
- 2 cage or welded wire fabric (negative) (cathode)
- 1 bulk anode (positive) (anode)
- 2 zinc mesh (positive) (anode)

**T457-4.3.2 Continuity Testing (Electrical Resistance Check):** Prior to installing any negative connections perform an electrical continuity test between all strands and spiral ties on all piles receiving cathodic protection. After the test is approved, the Contractor shall perform continuity corrections where necessary. Certified test results shall be submitted to the County for approval prior to pile jacket installation. Excavation for electrical continuity test shall be sealed with approved mortar after test within 20 hours.

If the electrical resistance tests reveal continuity between every strand and spiral, make local 4 inches x 4 inches excavation for the negative connection that will be needed for resistance welding to the spiral, then proceed to determine which jacket type is required. The 4 inches x 4 inches excavation can be located by the Contractor.

If the electrical resistance tests reveal that discontinuity exists in no more than two strands per face, perform Scheme 1 as detailed in the Contract Documents, then proceed to determine which jacket type is required.

If the electrical resistance tests reveal that discontinuity exists in three or more strands per face, perform Scheme 2 as detailed in the Contract Documents, then proceed to determine which jacket type is required.

A final report detailing the pile jacket system, which includes the testing of systems, potential survey measurements, results of the continuity testing, location of continuity corrections where applicable, and initial energizing information shall be submitted by the CP Specialist to the County.

**T457-5 Method of Measurement.**

- **T457-5.1 General:** All survey work shall be incidental to the CP systems installation.
- **T457-5.2 Cathodic Protection for Piles:** The quantity to be paid will be measured and paid for as per FDOT Specification 457 (cathodic protection pile jackets).

**T457-6 Basis of Payment.**

Price and payment for the pile jackets shall be for all work specified in this Technical Special Provision:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>457-1</td>
<td>Cathodic Protection Integral Pile Jacket (Non-Structural) (16.1”-30”)</td>
<td>linear foot</td>
</tr>
<tr>
<td>457-2</td>
<td>Cathodic Protection Integral Pile Jacket (Structural) (16.1”-30”)</td>
<td>linear foot</td>
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