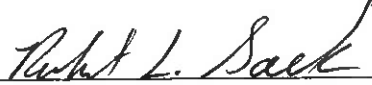


To: SUPERSEDED BY EI 13-004 EFFECTIVE 9/5/13 EI 08-047		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 08-047
Title: SECTION 731- SUBSURFACE TENSILE ELEMENTS			
Distribution: ☐ Manufacturers (18) ☐ Surveyors (33) ☒ Local Govt. (31) ☒ Consultants (34) ☒ Agencies (32) ☒ Contractors (39) ☐ _____ ()		Approved:  Robert L. Sack, P.E. Deputy Chief Engineer (Research) 6 DEC 08 Date	

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 7, 2009.
- Superseded issuance(s): This EI does not supersede any previous issuances.
- The information transmitted by this issuance will be incorporated into a future revision to the Standard Specifications.

PURPOSE: The purpose of this EI is to issue a new Standard Specification Section 731 *Subsurface Tensile Elements*.

TECHNICAL INFORMATION:

- The Standard Specification Section 211 *Internally Stabilized Cut Structures* is being issued concurrently via EI 08-046.
- The Construction Inspection Manual (CIM) Section 211 *Internally Stabilized Cut Structures* will be issued separately at a later date.
- Standard Specification §731-01 *Soil Nail Tendon Assembly* is created and assigned the material specifications relating to soil nail tendons.
- Standard Specification §731-01 *Soil Nail Tendon Assembly* includes a revision from the special specification. The revision is as follows:
 1. The material requirements for the solid bar nail tendons were expanded to include ASTM A722 for Grade 1035.
- Standard Specification §731-02 *Grouted Tieback Assembly* is created and assigned the material specifications relating to grouted tiebacks.
- Standard Specification §731-02 *Grouted Tieback Assembly* includes some revisions from the special specification. The revisions are as follows:
 1. The material requirements for the polypropylene for the sheath identified ASTM D2146 test method, which has been discontinued. This was updated to refer to ASTM D4101.
 2. The material requirements for the sheath were expanded to include corrugated PVC tubing as listing in Recommendations for Prestressed Rock and Soil Anchors by Post-Tensioning Institute.
 3. The material requirements for nitrates as part of the grease identified ASTM D992 test method, which has been discontinued. This was updated to refer to ASTM D3867.
 4. The material requirements for sulfides as part of the grease identified APHA – “Test Methods: Sulfides in Water”. This was revised to refer to ASTM D4658.

IMPLEMENTATION:

- The Main Office Design Quality Assurance Bureau will insert these standard specification shelf notes beginning with projects submitted for the letting of May 7, 2009.

TRANSMITTED MATERIALS:

- Standard Specification shelf notes of *Section 731 Subsurface Tensile Elements*.

BACKGROUND: The NYS Department of Transportation is implementing Transport SiteManager, including both Construction and Materials functionality. Implementation of standard AASHTO software enables SiteManager to allow revising this agency's practices to be more consistent with industry-accepted best practices. The revisions to the Standard Specifications are to minimize the overall quantity of special specifications.

CONTACT: Questions or comments regarding this issuance should be directed to Randall J. Romer, P.E. of the Geotechnical Engineering Bureau at (518) 457-4714, rromer@dot.state.ny.us.

SUBSURFACE TENSILE ELEMENTS

Make the following changes to the Standard Specifications dated May 4, 2006:

Page 989, **Delete** SECTION 731 (VACANT) and **Replace** it with the following:

SECTION 731 – SUBSURFACE TENSILE ELEMENTS

§731-01 – SOIL NAIL TENDON ASSEMBLY

SCOPE. This specification covers the material requirements for the components for assembling a soil nail tendon generally used in a Soil Nail Wall System (SNWS) to internally stabilize a cut and/or underpin a structure.

MATERIAL REQUIREMENTS.

A. SNWS Solid Bar Nail Tendons. Provide clean, straight, rust-free bar tendons meeting AASHTO M31 of Grade 420 or 520, ASTM A722 for Grade 1035. The deformed bar, continuous without splices or welds, undamaged, bare or epoxy coated or encapsulated (as shown on the approved Working Drawings), shall be threaded a minimum of 150 mm on the wall anchorage end to allow proper attachment of bearing plate and nut. Threading may be continuous spiral, deformed ribbing provided by the bar deformations (continuous threadbars) or may be cut into a reinforcing bar. If threads are cut into a reinforcing bar, the bar shall be sized based on the net throat of the threads.

B. SNWS Epoxy Coating. Provide epoxy coating conforming to the requirements of §709-04 *Epoxy-Coated Bar Reinforcement*. The Bend Test requirements are waived.

C. SNWS Encapsulation. Provide a minimum 1 mm thick corrugated HDPE tube conforming to AASHTO M252 or corrugated PVC tube conforming to ASTM D1784, Class 13464-B. Encapsulation shall provide at least 5 mm of grout cover over the nail bar and be resistant to ultraviolet light degradation, normal handling stresses, and grouting pressures. Factory fabrication of the encapsulation is preferred. Upon the Engineer's approval, the encapsulation may be field fabricated if done in strict accordance with the manufacturer's recommendations.

D. SNWS Centralizers. Provide centralizers manufactured from Schedule 80 PVC pipe or tube, steel, or any material not detrimental to the nail steel, except that wood shall not be used, and approved by the Engineer.

E. SNWS Bar Couplers. Provide bar couplers capable of developing 100% of the Guaranteed Ultimate Tensile Strength (GUTS) of the bar as certified by the manufacturer.

BASIS OF APPROVAL. Soil Nail Tendons will be approved based on the evaluation of the design submittal detailing the requirements of the assembly.

BASIS OF ACCEPTANCE. Soil nail centralizers, epoxy coating or encapsulation will be accepted on the basis of a material certification that the product conforms to this specification. Solid bar nail tendons and bar couplers (if allowed) will be accepted on the basis of a material certification that the product conforms to this specification and certified mill test results from each heat specifying the ultimate strength, yield strength, elongation, and composition indicating conformance to the design submittal and specification.

SUBSURFACE TENSILE ELEMENTS

§731-02 – GROUTED TIEBACK ASSEMBLY

SCOPE. This specification covers the material requirements for the components for assembling a grouted tieback generally used in a Grouted Tieback System (GTS) to internally stabilize and supplement the resisting force of an external support system retaining a cut and/or underpinning a structure.

MATERIAL REQUIREMENTS.

A. GTS Tendons. Provide clean, straight, rust-free tendons meeting the following:

1. "Uncoated Seven-Wire Stress Relieved Strand for Prestressed Concrete" - ASTM A416, or "Uncoated Seven-Wire Compacted Stress Relieved Strand for Prestressed Concrete" - ASTM A779, or
2. Continuously threaded "Uncoated High-Strength Steel Bar for Prestressing Concrete" - ASTM A722.

The tendons shall be of such size that the design load does not exceed 53% of the Guaranteed Ultimate Tensile Strength (GUTS) of the tendons.

B. GTS Couplers. Provide couplers for tendons capable of developing 100% of the GUTS.

C. GTS Sheath. Provide a sheath for corrosion protection encasing the entire stressing length of the tendon. Acceptable sheaths for the stressing length shall be one of the following:

1. A polyethylene (PE) tube applied over a corrosion inhibiting grease coated strand. The polyethylene shall be Type II, III or IV as defined by ASTM D1248. The tubing shall have a minimum wall thickness of 1.5 mm.
2. A hot-melt extruded polypropylene tube applied over a corrosion inhibiting grease coated strand. The polypropylene shall PP 210 B55542-11 as defined as ASTM D4101. The tubing shall have a minimum wall thickness of 1.5 mm.
3. A corrugated PVC tube applied over a corrosion inhibiting grease coated strand. The PVC tube shall conform to ASTM D1784 Class 13464-B. The tubing shall have a minimum wall thickness of 1.5 mm.
4. A heat shrinkable tube coated with an elastic adhesive applied over bar tendons. Prior to shrinking the tube shall have a nominal wall thickness of at least 0.6 mm and the elastic adhesive inside the tube shall have a nominal thickness of 0.5 mm. A smooth bond breaker shall be placed around the heat shrinkable tube in the free length.

D. GTS Grease. Provide a grease compound for corrosion inhibiting and lubricating properties to completely cover the steel in the stressing length. Provide grease for the stressing length meeting the requirements shown in Table 731-02-1 *Grease Properties*:

TABLE 731-02-1 GREASE PROPERTIES		
Property	Test Method	Acceptance Criteria
Dropping Point	ASTM D566	Minimum 149° C
Oil Separation @ 71° C	FTMS 791B Method 321.2	0.5% Maximum by mass
Water Content	ASTM D95	0.1% Maximum
Flash Point	ASTM D92	Minimum 149° C
Accelerated Corrosion Test: 5% Salt Fog @ 38° C @ 0.13 mm, min. hrs, Q Panel Type S	ASTM B117	Rust Grade 7 or better after 1000 hrs. of exposure according to ASTM D610

SUBSURFACE TENSILE ELEMENTS

TABLE 731-02-1 GREASE PROPERTIES			
Water Soluble Ions	Chlorides	ASTM D512	10 ppm Maximum
	Sulfides	ASTM D4500-S ² E	10 ppm Maximum
	Nitrates	ASTM D3867	10 ppm Maximum
Soak Test: 5% Salt Fog @ 38° C @ 0.13 mm coating, Q Panel Type S. (Immerse panels 50% in a 5% salt solution and expose to salt fog).		ASTM B117 (modified)	No emulsification of the coating after 720 hrs. of exposure.
Sheathing Compatibility: 40 days @ 66° C	Hardness Change	ASTM D4289	15% Change
	Volume Change	ASTM D4289	10% Change
	Tensile Strength Change	ASTM D638	30% Change

E. GTS Encapsulation. Provide encapsulation consisting of a tube of corrugated PVC, high density polyethylene or steel. The encapsulation shall have sufficient thickness to resist damage due to shipping, handling and installation.

F. GTS Centralizers and Spacers. Provide centralizers and spacers consisting of plastic, steel or any material not detrimental to the tendon. Wood shall not be used. Centralizers and spacers shall permit free flow of grout. Combination centralizer/spacers will be permitted.

G. GTS Trumpet. Provide a trumpet integral with the bearing plate. The trumpet shall consist of an epoxy coated steel pipe or tube conforming to the requirements of ASTM A53 for pipe or ASTM A500 for tubing. The trumpet shall have an inside diameter equal to or larger than the hole in the bearing plate, and shall be long enough to accommodate movements of the structure during loading and testing. For encapsulated strand tendons, the trumpet shall be long enough to enable the tendon to make a transition from the diameter of the tendon in the stressing length to the diameter of the tendon at the anchor head without damaging the encapsulation. A seal to retain grease or grout within the trumpet shall be provided between the trumpet and the stressing length corrosion protection. If grout is used to fill the trumpet, then the seal shall be a deformable seal. If grease is used to fill the trumpet, a description of the seal shall be submitted to the Engineer for approval.

BASIS OF APPROVAL. Grouted Tiebacks will be approved based on the evaluation of the design submittal detailing the requirements of the assembly.

BASIS OF ACCEPTANCE. Grouted Tieback Assembly will be accepted on the basis of a Material Certification for the grouted tieback centralizers and spacers, encapsulation, sheath, trumpet, and grease compound.

Grouted tieback tendons and couplers (if allowed) will be accepted on the basis of a material certification and certified mill test results from each heat specifying the ultimate strength, yield strength, elongation, and composition indicating conformance to the design submittal and this specification.

SUBSURFACE TENSILE ELEMENTS

Make the following changes to the Standard Specifications dated May 1, 2008:

Page 1046, **Delete** SECTION 731 (VACANT) and **Replace** it with the following:

SECTION 731 – SUBSURFACE TENSILE ELEMENTS

§731-01 – SOIL NAIL TENDON ASSEMBLY

SCOPE. This specification covers the material requirements for the components for assembling a soil nail tendon generally used in a Soil Nail Wall System (SNWS) to internally stabilize a cut and/or underpin a structure.

MATERIAL REQUIREMENTS.

A. SNWS Solid Bar Nail Tendons. Provide clean, straight, rust-free bar tendons meeting AASHTO M31 of Grade 60 or 75, ASTM A722 for Grade 150. The deformed bar, continuous without splices or welds, undamaged, bare or epoxy coated or encapsulated (as shown on the approved Working Drawings), shall be threaded a minimum of 6 in. on the wall anchorage end to allow proper attachment of bearing plate and nut. Threading may be continuous spiral, deformed ribbing provided by the bar deformations (continuous threadbars) or may be cut into a reinforcing bar. If threads are cut into a reinforcing bar, the bar shall be sized based on the net throat of the threads.

B. SNWS Epoxy Coating. Provide epoxy coating conforming to the requirements of §709-04 *Epoxy-Coated Bar Reinforcement*. The Bend Test requirements are waived.

C. SNWS Encapsulation. Provide a minimum 40 mil thick corrugated HDPE tube conforming to AASHTO M252 or corrugated PVC tube conforming to ASTM D1784, Class 13464-B. Encapsulation shall provide at least 3/16 in. of grout cover over the nail bar and be resistant to ultraviolet light degradation, normal handling stresses, and grouting pressures. Factory fabrication of the encapsulation is preferred. Upon the Engineer's approval, the encapsulation may be field fabricated if done in strict accordance with the manufacturer's recommendations.

D. SNWS Centralizers. Provide centralizers manufactured from Schedule 80 PVC pipe or tube, steel, or any material not detrimental to the nail steel, except that wood shall not be used, and approved by the Engineer.

E. SNWS Bar Couplers. Provide bar couplers capable of developing 100% of the Guaranteed Ultimate Tensile Strength (GUTS) of the bar as certified by the manufacturer.

BASIS OF APPROVAL. Soil Nail Tendons will be approved based on the evaluation of the design submittal detailing the requirements of the assembly.

BASIS OF ACCEPTANCE. Soil nail centralizers, epoxy coating or encapsulation will be accepted on the basis of a material certification that the product conforms to this specification. Solid bar nail tendons and bar couplers (if allowed) will be accepted on the basis of a material certification that the product conforms to this specification and certified mill test results from each heat specifying the ultimate strength, yield strength, elongation, and composition indicating conformance to the design submittal and specification.

SUBSURFACE TENSILE ELEMENTS

§731-02 – GROUTED TIEBACK ASSEMBLY

SCOPE. This specification covers the material requirements for the components for assembling a grouted tieback generally used in a Grouted Tieback System (GTS) to internally stabilize and supplement the resisting force of an external support system retaining a cut and/or underpinning a structure.

MATERIAL REQUIREMENTS.

A. GTS Tendons. Provide clean, straight, rust-free tendons meeting the following:

1. "Uncoated Seven-Wire Stress Relieved Strand for Prestressed Concrete" - ASTM A416, or "Uncoated Seven-Wire Compacted Stress Relieved Strand for Prestressed Concrete" - ASTM A779, or
2. Continuously threaded "Uncoated High-Strength Steel Bar for Prestressing Concrete" - ASTM A722.

The tendons shall be of such size that the design load does not exceed 53% of the Guaranteed Ultimate Tensile Strength (GUTS) of the tendons.

B. GTS Couplers. Provide couplers for tendons capable of developing 100% of the GUTS.

C. GTS Sheath. Provide a sheath for corrosion protection encasing the entire stressing length of the tendon. Acceptable sheaths for the stressing length shall be one of the following:

1. A polyethylene (PE) tube applied over a corrosion inhibiting grease coated strand. The polyethylene shall be Type II, III or IV as defined by ASTM D1248. The tubing shall have a minimum wall thickness of 60 mils.
2. A hot-melt extruded polypropylene tube applied over a corrosion inhibiting grease coated strand. The polypropylene shall PP 210 B55542-11 as defined as ASTM D4101. The tubing shall have a minimum wall thickness of 60 mils.
3. A corrugated PVC tube applied over a corrosion inhibiting grease coated strand. The PVC tube shall conform to ASTM D1784 Class 13464-B. The tubing shall have a minimum wall thickness of 60 mils.
4. A heat shrinkable tube coated with an elastic adhesive applied over bar tendons. Prior to shrinking the tube shall have a nominal wall thickness of at least 24 mils and the elastic adhesive inside the tube shall have a nominal thickness of 20 mils. A smooth bond breaker shall be placed around the heat shrinkable tube in the free length.

D. GTS Grease. Provide a grease compound for corrosion inhibiting and lubricating properties to completely cover the steel in the stressing length. Provide grease for the stressing length meeting the requirements shown in Table 731-02-1 *Grease Properties*:

TABLE 731-02-1 GREASE PROPERTIES		
Property	Test Method	Acceptance Criteria
Dropping Point	ASTM D566	Minimum 300° F
Oil Separation @ 160° F	FTMS 791B Method 321.2	0.5% Maximum by mass
Water Content	ASTM D95	0.1% Maximum
Flash Point	ASTM D92	Minimum 300° F
Accelerated Corrosion Test: 5% Salt Fog @ 100° F @ 5 mil, min. hrs, Q Panel Type S	ASTM B117	Rust Grade 7 or better after 1000 hrs. of exposure according to ASTM D610

SUBSURFACE TENSILE ELEMENTS

TABLE 731-02-1 GREASE PROPERTIES			
Water Soluble Ions	Chlorides	ASTM D512	10 ppm Maximum
	Sulfides	ASTM D4500-S ² E	10 ppm Maximum
	Nitrates	ASTM D3867	10 ppm Maximum
Soak Test: 5% Salt Fog @ 100° F @ 5 mil coating, Q Panel Type S. (Immerse panels 50% in a 5% salt solution and expose to salt fog).		ASTM B117 (modified)	No emulsification of the coating after 720 hrs. of exposure.
Sheathing Compatibility: 40 days @ 150° F	Hardness Change	ASTM D4289	15% Change
	Volume Change	ASTM D4289	10% Change
	Tensile Strength Change	ASTM D638	30% Change

E. GTS Encapsulation. Provide encapsulation consisting of a tube of corrugated PVC, high density polyethylene or steel. The encapsulation shall have sufficient thickness to resist damage due to shipping, handling and installation.

F. GTS Centralizers and Spacers. Provide centralizers and spacers consisting of plastic, steel or any material not detrimental to the tendon. Wood shall not be used. Centralizers and spacers shall permit free flow of grout. Combination centralizer/spacers will be permitted.

G. GTS Trumpet. Provide a trumpet integral with the bearing plate. The trumpet shall consist of an epoxy coated steel pipe or tube conforming to the requirements of ASTM A53 for pipe or ASTM A500 for tubing. The trumpet shall have an inside diameter equal to or larger than the hole in the bearing plate, and shall be long enough to accommodate movements of the structure during loading and testing. For encapsulated strand tendons, the trumpet shall be long enough to enable the tendon to make a transition from the diameter of the tendon in the stressing length to the diameter of the tendon at the anchor head without damaging the encapsulation. A seal to retain grease or grout within the trumpet shall be provided between the trumpet and the stressing length corrosion protection. If grout is used to fill the trumpet, then the seal shall be a deformable seal. If grease is used to fill the trumpet, a description of the seal shall be submitted to the Engineer for approval.

BASIS OF APPROVAL. Grouted Tiebacks will be approved based on the evaluation of the design submittal detailing the requirements of the assembly.

BASIS OF ACCEPTANCE. Grouted Tieback Assembly will be accepted on the basis of a Material Certification for the grouted tieback centralizers and spacers, encapsulation, sheath, trumpet, and grease compound.

Grouted tieback tendons and couplers (if allowed) will be accepted on the basis of a material certification and certified mill test results from each heat specifying the ultimate strength, yield strength, elongation, and composition indicating conformance to the design submittal and this specification.