

## ORIGINATION FORM

**THE INFORMATION BELOW IS TO BE PROVIDED BY THE ORIGINATOR**

Modify Specification \_\_\_\_\_ 933 \_\_\_\_\_  
Section/File number

New Section \_\_\_\_\_  
Section number

**Subject:** Prestressing Steel

**Origination date:** 1-09-12

**Originator:** Vickie Abalo  
**Office/Phone:** Structures Design/ (850) 414-4301  
**Email address/** vickie.abalo@dot.state.fl.us  
**Userid:** st986va

**Problem statement:** The following Sections will be modified:

- Section 933-1 has been modified to eliminate the information that is provided by ASTM A-416, referenced in the Section. Stressed relieved strands are no longer the industry standard, and the revised Section will specify Grade 270, low relaxation strands.
- Section 933-2 has also been modified to eliminate limitations which are no longer current. This Section now references ASTM A-722 (Type II). Section 933-5.3 has also been revised to meet the ASTM A-722 Proof Testing criteria.
- Sections 933-3 and 933-4 have been reorganized to provide clarity and add references to the new Section 960 for prestressing components.
- Section 933-5 has been updated to meet the current testing requirements and acceptance criteria provided by the SMO.

**Information source:** Charles Boyd, Ghulam Mujtaba, Gevin McDaniel, Daniel Scheer, Michael Bergin, Richard DeLorenzo, Steve Nolan

**Background data:** As Section 933-1 is currently written the standard is stress relieved strand and low relaxation is an exception to the Specification. The current industry standard uses Grade 270, high-tensile strength, 7-wire low relaxation strand. In addition Tables 1, 2, and 3 in Section 933-1 provide requirements for 9/16 inch strand, which was not part of ASTM A416 when the original specification was



## *Florida Department of Transportation*

RICK SCOTT  
GOVERNOR

605 Suwannee Street  
Tallahassee, FL 32399-0450

ANANTH PRASAD, P.E.  
SECRETARY

### MEMORANDUM

**DATE:** May 23, 2012  
**TO:** Specification Review Distribution List  
**FROM:** Duane Brautigam, Director, Office of Design  
**SUBJECT:** Proposed Specification: **9330000 Prestressing Steel.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

This change was proposed by Vickie Abalo to upgrade spec to current industry standard.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or to my attention via e-mail at SP965DB or duane.brautigam@dot.state.fl.us. Comments received after **June 20, 2012**, may not be considered. Your input is encouraged.

DB/cah  
Attachment

**ACCESSORY MATERIALS FOR PRESTRESSED CONCRETE.**  
**(REV 1-9-12)**

SECTION 933 (Pages 885 – 887) is deleted and the following substituted:

**SECTION 933**  
**ACCESSORY MATERIALS**  
**FOR PRESTRESSED CONCRETE *PRESTRESSING STEEL***

**933-1 Cables *Strands* for Pretensioning *Prestressing*.**

The ~~cables~~ *strands* for prestressing concrete members shall be *Grade 270, high-tensile-strength, 7-wire low-relaxation* strand *and shall* conforming to the requirements of ASTM A-416 with the addition of 9/16 inch strand meeting the following requirements:

<b>TABLE 1</b>			
<b>BREAKING STRENGTH REQUIREMENTS</b>			
Nominal Diameter of Strand, inch	Breaking Strength of Strand, lbf	Nominal Steel Area of Strand, in <sup>2</sup>	Nominal Weight of Strands, lb/1,000 ft
<i>Grade 270</i>			
<i>9/16</i>	<i>51,700</i>	<i>0.191</i>	<i>650</i>

<b>TABLE 2</b>		
<b>YIELD STRENGTH REQUIREMENTS</b>		
Nominal Diameter of Strand, inch	Initial Load, lbf	Minimum Load at 1% Extension, lbf
<i>Grade 270</i>		
<i>9/16</i>	<i>5,170</i>	<i>43,940</i>

<b>TABLE 3</b>	
<b>DIAMETER RELATION BETWEEN CENTER AND OUTER WIRES</b>	
Nominal Diameter of Strand, inch	Minimum Difference Between Center Wire Diameter and Diameter of any Outer Wire, inch
<i>Grade 270</i>	
<i>9/16</i>	<i>0.003</i>

~~As an exception to the above, at the Contractor's option, stabilized strands may be used in lieu of stress relieved strands. Calculations shall be submitted, showing the substitution meets the following requirements:~~

- ~~1. The strands meet all the requirements of ASTM A-416, Grade 270.~~
- ~~2. The net compressive stress in the concrete after all losses is at least as large as that provided by the stress relieved strands.~~
- ~~3. The ultimate strength of the structure with the new strands meets the requirements of the applicable AASHTO Specifications.~~

**933-2 Bars for ~~Posttensioning~~ *Prestress*ing.**

The bars shall be of high tensile strength steel, and shall be equipped with wedge tool end anchorages which will develop the minimum specified ultimate bar stress on the nominal bar area. The physical properties of the bar steel and the stress strain curve, determined by static tensile tests, shall conform to the following:

Ultimate stress, minimum .....	145,000 psi
Stress at 0.7% elongation, minimum .....	130,000 psi
Stress at 0.3% elongation, minimum .....	75,000 psi
Elongation in 20 diameters, minimum .....	4%
Modulus of elasticity, minimum .....	25,000,000

~~Diameter tolerance — +0.02375 or -0.010 inch~~ *for prestressing concrete members shall conform to the requirements of ASTM A-722, Type II.*

**933-3 Parallel Wire Assemblies for ~~Posttensioning~~ *Prestress*ing.**

The wire assemblies *for prestressing concrete members* shall consist of parallel wires of the number and size shown in the plans. ~~Wires and~~ shall conform to the requirements of ASTM A-421, ~~with Type BA (Button Anchorage) used for cold end deformations and Type WA used for the wedge type anchorage without cold end deformations.~~ At the option of the Contractor, stabilized strands may be used in lieu of stress relieved strands provided calculations are submitted, showing the substitution meets the requirements specified in 933-1 for stabilized strands.

**933-4 Anchorages for ~~Posttensioned~~ *Prestress*ing Tendons.**

**933-4.1 For *Strands and Bars*:** ~~Wedge type anchorages shall be used for bars. The wedge device shall develop the minimum ultimate stress specified for the nominal bar area. Wedge anchorages shall bear against anchorage plates fabricated of hot rolled steel having physical characteristics not less than as specified for No. 1040 of the American Iron and Steel Institute (AISI) Specifications~~ *Meet the requirements of Section 960.*

**933-4.2 For Parallel Wire Assemblies:** Anchorage for parallel wire assemblies may be provided by *Type BA (Button Anchorages)* cold-end deformation of the wires (~~Button Anchorage~~) bearing against suitable anchorage plates, or by *Type WA (Wedge-type anchorages) without cold end deformations*, of the sandwich-plate or conical type. The anchorage device shall be capable of developing at least 90% of the specified ultimate strength of the total number of wires anchored.

Conical type anchorages shall be embedded within the ends of the concrete members unless otherwise specified. Anchorages shall generally bear against embedded grids of reinforcing steel of approved type.

~~**933-4.3 Alternates for Both Types:**~~ Alternate type anchorages will be considered if proposed by the Contractor. Any alternate anchorage will be required to develop the full specified ultimate strength for bars or at least 90% of the specified ultimate strength for parallel wire assemblies.

~~As a specific exception, threaded anchorages not on upset or over size reinforcing ends will not be considered.~~

**933-5 Required Tests for ~~Reinforcing~~ *Prestress*ing Steel.**

**933-5.1 General:** Tests shall be ~~made~~ *performed* to determine the physical characteristics of prestressing reinforcement. For tests specified to be made by the manufacturer, certified

copies of all test results shall be submitted to the Department and the Department shall be privileged to have all tests witnessed by its Inspectors.

**933-5.2 Cables, Wires and Wire Anchorages Strands:** Acceptance of ~~cables, wires and wire anchorages~~ *prestressing strands* shall be based on *samples taken by the Department and the manufacturer's certified mill analysis of certifying that the test results meeting the S specification limits of ASTM or AASHTO as specifically designated. Prior to use, submit to the Engineer the manufacturer's certified mill analysis for each heat or production LOT per shipment of strand.*

Certifications ~~of cable~~ for prestressing *strand* shall contain, for each heat number or production LOT, all test results required by ASTM A-416 and the modulus of elasticity expressed in psi or the stress-strain curve with units identified.

~~Random samples may be selected and tested by the Department for verification purposes~~ *The Engineer will select samples and certified mill analysis representing each shipment at a frequency of one sample per manufacturer, per size of strand, per shipment.*

### **933-5.3 Bars:**

~~933-5.3.1 Proof Test:~~ During manufacture each bar shall be proof tested to a minimum stress of 130,000 psi.

~~933-5.3.2 Static Test:~~ From each mill heat received, one static test shall be made by the manufacturer on an assembled bar and anchorage, to determine the physical properties of the steel and the assembly. Such physical properties shall conform to the minimum physical properties specified in 933-2. *Acceptance of prestressing bar shall be based on samples taken by the Department and the manufacturer's certified mill analysis certifying that the test results meet specification limits of the ASTM or AASHTO as specifically designated. Prior to use, submit to the Engineer the manufacturer's certified mill analysis for each heat or production LOT and size per shipment of bars. Certifications of prestressing bar shall contain, for each heat number or production LOT, all test results required by ASTM A-722 and the modulus of elasticity expressed in psi or the stress-strain curve with units identified.*

*The Engineer will select samples and certified mill analysis representing each shipment at a frequency of one sample per heat or production LOT, per size of bar, per shipment.*

**933-5.4 Wires:** Acceptance of wires shall be based on the manufacturer's certified mill analysis of test results meeting the specification limits of the ASTM or AASHTO as specifically designated. *Prior to use, submit to the Engineer the manufacturer's certified mill analysis for each heat or production LOT and size per shipment of wire. Certifications of prestressing wire shall contain, for each heat number or production LOT, all test results required by ASTM A-421.*

written. Currently 9/16 inch strand has been added to ASTM A416, so the three tables can now be removed from this Section. Some additional historical research was done prior to the proposed changes to understand why we currently have limitations for bars for prestressing in lieu of referencing ASTM A722. Section 933-2 of the Specifications has not been revised or updated since 1964. These limitations were added prior to the approval of ASTM A722, which did not happen until 1975. According to the SMO, material and quality improvements have been made since that time but the Specification was never modified to incorporate these changes. Section 933-2 is being revised to match the current Section 462 that specifies uncoated Grade 150, high strength, coarse thread bar of ASTM A722, Type II. Further modification and organization to Section 933 will allow the Section to work with the proposed modifications to Section 462 and to proposed Section 960.

**Recommended**

**Usage Note:** For projects using prestressing steel.

**Estimated fiscal impact, if implemented:**

None

**Implementation of these changes, if and when approved, will begin with the January 2013 letting.**