SECTION 406

REINFORCING STEEL

I. GENERAL

1.1 DESCRIPTION OF WORK

The Contractor shall furnish, fabricate, place and protect all reinforcing steel or wire mesh (including all wires, ties, clips, supports, chairs, spacers, and other accessories), used in concrete operations and masonry construction, all in accordance with the Contract Documents.

1.2 MATERIALS

Materials shall be furnished by the Contractor in accordance with Section 200.

1.3 SUBMITTALS

A. Submittals shall be made by the Contractor in accordance with the procedures set forth in Section 105 and as described below:

The Contractor shall submit complete shop drawings of all material proposed to be furnished and installed under this Section. These drawings shall include:

1. Bar schedules, stirrup spacing, diagrams of bent bars, reinforcement arrangement and assemblies, bar splices and laps.

2. The drawings shall provide sufficient detail to permit placement of reinforcement without use of design drawings.

3. Shop drawings shall satisfy the requirements of ACI Standard 315.

B. Accompanying the shop drawings, the Contractor shall submit the steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel.

C. Where mechanical couplers are required or permitted to be used to splice reinforcing steel, the Contractor shall submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.

D. If reinforcing steel is spliced by welding at any location, the Contractor shall submit mill test reports that shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. The Contractor shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding.

E. Welders shall be qualified per AWS and Contractor shall submit welder qualifications prior to beginning work.

II. EXECUTION

2.1 FABRICATION

A. Bent bar reinforcement shall be cold bent to the shape shown on the Drawings. Fabrication shall be in accordance with the requirements of the *Manual of Standard Practice for Detailing Reinforced Concrete Structures* (ACI 315).

B. Spiral bars shall be fabricated to have the proper diameter when placed in position at the pitch shown on the Drawings. Each end of a spiral bar shall have 1-1/2 finishing turns at each end in a plane perpendicular to the axis of the spiral.

C. Bars shall be tagged with non-rusting tags showing shop-drawing numbers.

2.2 PLACING AND FASTENING

A. Steel reinforcement shall be firmly held during the placing and setting of concrete. Bars, except those to be placed in vertical mats, shall be tied at every intersection where the spacing is more than 12-inches in any direction. Bars in vertical mats and in other mats where the spacing is 12-inches or less in each direction shall be tied at every intersection or at alternate intersections provided such alternate ties accurately maintain the position of steel reinforcement during the placing and setting of concrete.

B. Tie wires for use with epoxy-coated steel shall be plastic coated or epoxy coated.

C. Following placement of epoxy-coated reinforcement and prior to concrete placement, the reinforcement will be inspected by the Owner. All visible damage of the epoxy coating shall be repaired in accordance with the requirements of Section 200.

D. The minimum clear distance from the face of concrete to any reinforcing bar shall be maintained as shown on the Drawings. When not shown on the Drawing the following clearances shall be maintained:

1. Concrete cast against earth: 3-inches

2. Concrete exposed to earth or weather: 2-inches

E. When specified for corrosive or marine environments or under other severe exposure conditions, the minimum cover shall be increased by 1-inch except where epoxy-coated reinforcement is used. Bars that must be positioned by maintaining clearances from more than one face shall be centered so that clearances indicated by the Drawing dimension of bars are equalized.

F. Bars shall be placed so that the concrete cover as indicated on the Drawings shall be maintained within a tolerance of 0 to + 1/2-inch in the finally cast concrete.

G. Where anchor bolts interfere with reinforcing steel, the steel position shall be adjusted without cutting to permit placing anchors in their proper locations.

H. Precast concrete bar supports shall have a 28-day compressive strength of at least 4,500 pounds

per square inch and shall be from the VDOT list of approved products for the use specified. Supports shall be furnished with epoxy-coated or plastic ties or shaped to prevent slippage from beneath the reinforcing bar. Metal bar supports shall be fabricated from one of the following:

1. Stainless steel wire conforming to the requirements of ASTM A493; or,

2. Cold-drawn wire protected by plastic coating conforming to CRSI standards, epoxy coating, or other protective coatings as approved by the Owner.

Bar supports shall be spaced as recommended by CRSI but not more than 4-feet apart transversely or longitudinally. Precast concrete supports shall be less than 1-foot in length and staggered so as not to form a continuous line. The lower mat of steel reinforcement shall be supported by a bolster block or individual bar chair supports, and the upper mat shall be supported by high chair supports. Bar supports shall be firmly stabilized so as not to displace under construction activities. Reinforcing bar supports (Standees) may be used for the top mat of steel of simple slab spans provided they hold the reinforcing steel to the requirements specified herein and are firmly tied to the lower mat to prevent slippage. The use of standees will not be permitted for the top mat of steel on any continuous slab spans.

I. In reinforced concrete sections, the specified clear distance from the face of the concrete to any reinforcing bar and the specified spacing between bars shall be maintained by means of approved types of stays, ties, hangers, or other supports. The use of pieces of gravel, stone, brick, concrete, metal pipe, or wooden blocks will not be permitted as supports or spacers for reinforcing steel. The use of precast concrete block supports will be permitted provided blocks are furnished in correct thicknesses and are shaped or tied to prevent slippage from beneath reinforcing bars. The clear distance between bars shall be at least 1-1/2 times the specified maximum size of coarse aggregate, but not less than 1-1/2 inches. Before concrete is placed, reinforcing steel shall be inspected and approved by the Owner-for proper position and the adequacy of the method for maintaining position.

J. Welded wire mesh shall be placed in slabs as indicated. Mesh placement at joints shall be as indicated. Laps for sheets of welded wire fabric or bar mat reinforcement shall be at least one full mesh in width. Laps shall be staggered to avoid continuous laps in either direction. Mesh shall be wired or clipped together at laps at intervals not to exceed 4 feet. Mesh shall be positioned by the use of supports. Welded wire mesh shall be in flat sheets, not in rolls.

2.3 SPLICING AND LAPPING

A. Reinforcement shall be furnished in full lengths as indicated on the Drawings. Except where shown on the Drawings, splicing bars will not be permitted without the written approval of the Owner. Splices shall be as far apart as possible.

B. Bars shall be lapped in accordance with ACI 318/318R. In lapped splices, bars shall be placed in contact and wired together. Mechanical butt splicing when approved by the Owner or shown on the Drawings will be permitted provided the mechanical connection develops in tension or compression, as required, at least 125 percent of the specified yield strength of the bar. Reinforcing steel shall be welded only if specified on the Drawings. Welding shall be in accordance with the requirements of Paragraph 1.2 (D) and in accordance with VDOT Section 407.

III. MEASUREMENT FOR PAYMENT

A. Reinforcement steel, when a pay item, will be measured in pounds of steel placed in the structure as shown on the Drawings or Standard Details. The weight of welded wire mesh will be computed from the theoretical weight per square yard placed, including allowance for laps not to exceed 8 percent of the net area.

B. Epoxy-coated reinforcement steel, when a pay item, will be measured in pounds of uncoated steel and will be paid for at the contract unit price per pound. The weight will be computed from the theoretical weights of the nominal sizes of steel specified and placed in the structure. Measurement will not be made for epoxy-coating material.

C. When not a pay item, the cost of reinforcing steel shall be included as an incidental item in the bid price for other specified pay items.

D. Items considered incidental work will not be measured for payment or paid for as such. Incidental items are identified in Section 109.1.1 and also include the following:

Furnishing, applying, and repairs of epoxy-coating material.

E. No payment will be made for fastening devices that may be used by the Contractor for keeping reinforcing bars in their correct position. When the substitution of larger bars than those specified is allowed, payment will be made for only the amount of metal that would have been required if the specified size of bar had been used. When full-length bars are shown on the Drawings and the Contractor obtains approval to use short bars for convenience, the weight paid for will be based on the full-length dimensions with no allowance make for splices.

F. Reinforcing Steel or Welded Wire Mesh.

Reinforcing steel or welded wire mesh will be paid for at the contract unit price per pound.

G. Epoxy-coated Reinforcing Steel.

Epoxy-coated reinforcing steel will be paid for at the contract unit price per pound.

End of Section