

shall be taken in placing and finishing curbs and sidewalks to insure that they are placed true to line and grade and meet ADA requirements. The surface shall be screeded and floated and accepted by the Engineer.

**702.37 Measurement and Payment.** Measurement and payment for concrete structures will not be specifically made under this section of the specifications. Measurement and payment will be made in accordance with other sections of these specifications that govern the items of work included in the concrete structure.

## SECTION 703

### REINFORCING STEEL

**703.01 Description.** Work under this section shall consist of furnishing and placing concrete reinforcing steel consisting of bars, wire, wire mesh, bar supports and ties.

#### MATERIALS

**703.02 Reinforcing Bars.** Reinforcing bars and dowels shall conform to AASHTO M 31 (ASTM 615), *Deformed and Plain Billeted-Steel Bars for Concrete Reinforcement*, and shall be Grade 60 unless otherwise specified. Acceptance or rejection shall be based on 36 inch long samples taken in the field.

**703.03 Wire and Wire Fabric.** Wire for concrete reinforcement, either as such or in fabricated form, shall conform to AASHTO M 32 (ASTM A 82), *Steel Wire, Plain, for Concrete Reinforcement* or AASHTO M 225 (ASTM A 496), *Steel Wire, Deformed for Concrete Reinforcement*. Welded steel wire fabric for concrete reinforcement shall meet the requirements of AASHTO M 55 (ASTM A 185), *Steel Welded Wire Fabric, Plain, for Concrete Reinforcement*.

## **703.04 Galvanized Reinforcing Bars.**

**A. Zinc-coated Galvanized Reinforcing Steel.** Zinc-coated galvanized reinforcing shall be used in the construction of structural concrete for reinforcement when shown on the plans and shall extend to the limits shown. Zinc-coated reinforcing steel for structures shall be hot-dip galvanized in accordance with ASTM A 767, Class II, two ounces per square foot with a minimum thickness of 3.5 mils. The bars shall be galvanized after fabrication.

Reinforcing steel produced by Thermex method (water quenching) shall not be used.

### **B. Repair of Materials.**

**1. Shop Repair of Coated Bars.** Zinc-coated reinforcing steel bars that do not meet the requirements above shall be rejected and shall not be repaired.

**2. Field Repair of Coated Bars.** The Contractor shall be required to field repair damaged areas of the bar coating and to replace bars exhibiting severely damaged coatings. Field repair material shall have a minimum 65% zinc by weight. Thickness of repair shall not be less than 3.5 mils.

The Engineer shall be the sole judge of the severity to damaged areas for purposes of repair or replacement. A reinforcing bar having a coating determined by the Engineer to be severely damaged shall not be incorporated in the work and it shall be removed from the work site. All such bars shall be replaced in kind by the Contractor at no additional cost to the Department.

**C. Handling, Placing, and Fastening.** All systems for handling galvanized coated bars shall have padded con-

tact areas for the bars, wherever possible. All bundling bands shall be padded and all bundles shall be lifted with multiple supports or a platform bridge so as to prevent bar to bar abrasion from sags in the bar bundle. The bars or bundles shall not be dropped or dragged.

The tie wire shall be plastic coated and chairs and metal supports shall, at the Contractor's option, be either zinc or plastic coated. The specific hardware that the Contractor proposes to use shall be approved by the Engineer.

### **703.05 Mechanical Reinforcing Couplers.**

**A. Materials.** All coupler components shall be compatible with the reinforcing bars specified in this subsection. Splices made with mechanical couplers shall be as detailed on the plans or authorized in writing by the Engineer. The Contractor shall supply to the Engineer detailed assembly instructions from the coupler manufacturer, of each type of coupler being used. Couplers shall provide a tensile/compressive restraint of 125% of the yield strength of the reinforcing bar without any sign of failure.

Slippage of the coupler on the rebar is considered a failure.

**B. Testing.** The test shall use reinforcing bar samples and couplers from production lots being used on the project. A minimum of one coupler and rebar assembly shall be tested for each size or production lot of rebar and/or coupler to be used on the project. The Contractor may have the assembly tested by an independent laboratory instead of testing by the Department. Certified test results shall be furnished to the Engineer for the independent tests. The cost of this independent testing shall be the responsibility of the Contractor. In either case, the Engineer will witness the rebar/coupler test samples being assembled. The testing shall be conducted based on tensile loading of the coupled reinforcing through yield point and

to complete failure. Written test results shall include:

1. The value of 125% of the theoretical yield point of the rebar being tested.
2. Indicate that there is no failure of the coupler at 125% of yield, and
3. The tensile strength at which the rebar/coupler assembly failed.

The SCDOT reserves the right to request check samples of rebar/coupler assemblies to verify independent laboratory results. Test assemblies shall be 36 inches in length with components being randomly selected from material delivered to the project.

**C. Handling and Storage.** If construction is staged such that each coupled bar is not simultaneously required to be placed, the second bar shall be stored and protected at the site under the direction of the Engineer. The mechanical coupler, if of the threaded type, shall be placed on the bar in place in the finished structure in such a way to protect the threaded end of the bar. Additionally, the open end of the coupler shall be capped. Regardless of the method of mechanical coupling used, the Contractor shall exercise extreme caution in preventing damage to reinforcing or coupling devices that will inhibit or affect the certified behavior of the device. If in the Engineer's opinion, such damage is deemed to exist, the Contractor shall supply and replace the reinforcing, couplers, or both at his own expense.

The choice of coupler shall be made with consideration given to the clearance requirements for correct installation and proper alignment of the reinforcing after installation.

### **703.06 Bar Supports.**

**A. Wire Supports.** Wire supports shall comply with

standard type and classes of protection as specified in *CRSI Manual of Standard Practice*, latest edition.

Wire supports shall be spaced to provide adequate support for slab reinforcing steel. For flat slab spans the lower layer of slab steel shall be supported by Beam Bolster (BB) bar supports with one row near each end of span and interior rows spaced approximately 24 inches on center. For beam spans, the lower layer of slab steel shall be supported by Beam Bolster (BB) bar supports approximately 36 inches on center with a minimum of three rows between longitudinal beams and one row on each overhang placed not more than 12 inches from edge of slab. BB bar supports shall have Class 1 maximum protection unless shown otherwise in the plans. Top reinforcing bars shall be supported by Continuous High Chairs Upper (CHCU) or Beam Bolster Upper bars (BBU) as shown on the plan details spaced a maximum of 30 inches on centers.

Tie wire for use with galvanized coated bars shall be galvanized in accordance with AASHTO M 232 (ASTM A 153), Class D or plastic coated with a material compatible with the galvanized coated bars.

**B. Plastic Bar Supports.** Plastic Bar Supports may be used as an alternate to wire BB and BBU bar supports. When used, plastic bar supports shall meet the following requirements:

1. Chairs and bolsters must be of adequate strength to resist a 300 pound concentrated load without permanent deformation or breakage.
2. The material from which plastic bar supports is manufactured shall be either resin or first generation recycled thermoplastic resin, be colored white, gray, or black, and be chemically inert in concrete.
3. Plastic reinforcing bar supports shall be molded in a

configuration that does not restrict concrete flow and consolidation around and under the reinforcing bar support.

**C. Concrete Blocks.** Where concrete is to be placed directly on soil, concrete blocks may be used to support reinforcing bars. The blocks for holding the lower reinforcing bars in position shall be cast to approved shape and dimension from concrete of the same materials and proportions as that to be used in the structure, and shall be properly cured. The blocks shall not be over 6 inches in length and shall be placed to permit their ends to be covered with concrete. The use of pebbles, pieces of broken stone or brick, metal pipe or wooden blocks, shall not be permitted.

**D. Measurement.** Weights of the bar supports are not included in the reinforcing steel quantities. Bar supports shall be considered incidental to the reinforcing steel and all cost of furnishing and placing bar supports shall be included in the contract unit price for Reinforcing Steel.

## CONSTRUCTION REQUIREMENTS

**703.07 Protection of Materials.** Steel reinforcement shall be stored on platforms, skids, or other supports raised above the surface of the ground, and shall be protected as far as practicable from mechanical injury, surface deterioration, and mud splatter. When placed in the Work, it shall be free from loose or thick rust, dirt, scale, dust, paint, oil, concrete mortar, curing compound, or other foreign material. The surface condition of the reinforcement shall be subject to the Engineer's approval before placing it in the structure.

**703.08 Bending.** The reinforcement shall be bent accurately to the shapes shown on the plans. Competent personnel shall be employed for cutting and bending, and proper appliances shall be provided for such work. Bar bending shall be in accordance with recommendations in the CRSI *Manual of Standard Practice*, unless otherwise shown on the plans. All

dimensions relative to clearances are from the edge of the reinforcing steel to the edge of the concrete. All dimensions relative to spacing of reinforcing steel are from center to center of bars. Overall lengths of bars shown in the steel tables are the overall lengths of bars along their centerlines after bending. Finished bars shall conform to the shapes and dimensions called for. The fabricator shall make any allowances necessary to account for creep in the bars during bending to secure the shapes and dimensions called for on the plans and in the special provisions.

**703.09 Placing and Fastening.** All reinforcement shall be accurately placed and, during the placing and consolidation of concrete, firmly held in the positions shown on the plans. Distances from the forms and between layers shall be maintained by means of concrete blocks, hangers, bolsters or other approved supports complying with requirements of Subsection **703.06**.

The reinforcement shall be held together by wiring at all intersections except where the spacing is 12 inches or less in each direction, in which case alternate intersections shall be tied. Bars projecting beyond a construction joint shall be held in place by templates during concreting to insure proper position.

Before concrete is deposited in the forms, the Contractor shall replace or bend back any steel or wires that project nearer the forms than specified by the plans. Reinforcement that is not in its proper position, properly wired, and cleaned as specified in Subsection **703.07** shall be corrected to the satisfaction of the Engineer. Concrete shall not be deposited until the Engineer has inspected the condition of the reinforcing steel and given permission to place concrete. Unless otherwise provided or permitted by the Engineer, reinforcement shall not be placed during the placing of concrete.

### **703.10 Splicing of Bars.**

**A. General.** All reinforcement shall be furnished in the

full lengths indicated on the plans unless otherwise permitted. Except for splices shown on the plans, splicing of bars will be permitted only with advance written approval of the Engineer. Splices shall be staggered when possible.

**B. Lapped Splices.** Lapped splices shall be of the length shown on the plans. If not shown on the plans, the length of lapped splices shall be in accordance with AASHTO *Standard Specifications for Highway Bridges*, and approved by the Engineer. In lapped splices, the bars shall be placed and wired to maintain the minimum distance to the surface of the concrete shown on the plans.

**C. Welded Splices.** Welded splices shall be used only if detailed on the plans or with the written approval of the Engineer. Welding shall conform to the AWS D1.4 *Structural Welding Code, Reinforcing Steel*.

Welded lap splices shall be made with Low Hydrogen type electrodes. The welding procedure and two test samples shall be submitted for approval by the Department before beginning the fabrication of the splices. Hot dipped galvanized welded bars shall be repaired by use of a zinc rich formulation subject to approval of the Engineer.

**D. Mechanical Splices.** Mechanical splices shall meet the requirements of Subsection **703.05**.

**703.11 Method of Measurement.** Reinforcing steel bars for structures will be measured as the number of pounds of steel accepted in place.

The diameter, area, and theoretical weight of reinforcing bars will be computed using Table 1a in AASHTO M 31.

The weight of reinforcing wire, welded wire fabric, and plain bar of sizes other than those listed in Table 1a referenced above, will be computed from tables of weight pub-

lished by CRSI or computed using nominal dimensions and an assumed unit weight of 490 pounds per cubic foot. The cross-sectional area of wire in square inches will be assumed to be equal to its MW or MD-Size Number. If the weight per square unit of welded wire fabric is given on the plans, that weight will be used.

The weight of reinforcement used in precast members, where payment for the reinforcement is included in the contract price for the member will not be measured. Threaded bars or dowels placed in the Work and used to attach such members to cast-in-place concrete after the installation of precast members will be measured.

No allowance shall be made for clips, wire, separators, wire chairs, and other material used in supporting, spacing and fastening the reinforcement in place nor for galvanizing such items. If bars are substituted upon the Contractors request and as a result more steel is used than specified, only the amount specified will be measured.

The additional steel required for splices that is not shown on the plans but is authorized as provided herein, will not be measured. Mechanical couplers will not be measured, but shall be considered incidental to the furnishing of reinforcing steel.

No allowance will be made for the weight of galvanizing in computing the weight of reinforcing steel.

**703.12 Basis of Payment.** Payment for the quantity of each class of reinforcing steel shown in the bid schedule will be made at the contract unit price for the appropriate item, which price and payment shall be full compensation for furnishing, fabricating, cut, splicing, repairing or replacing, placing, and

securing reinforcing steel and including all materials, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work.

Payment for each item includes all direct and indirect costs and expenses required to complete the work.

Payment will be made under:

<b>Item No.</b>	<b>Pay Item</b>	<b>Pay Unit</b>
7031100	Reinforcing Steel for Structures (Roadway)	Pound
7031105	Reinforcing Steel for Structures (Retaining Wall)	Pound
7031200	Reinforcing Steel for Structures (Bridge)	Pound
7031210	Spiral Reinforcing Steel for Structures (Bridge)	Pound
7031400	Galvanized Reinforcing Steel for Structures (Bridge)	Pound

## **SECTION 704**

### **PRESTRESSED CONCRETE**

**704.01 Description.** This work shall consist of the manufacture, handling, and installation of precast, prestressed concrete beams, slabs, channels and other prestressed concrete members in structures. The manufacture and handling of precast prestressed concrete piles is also a part of this section. The work shall be in accordance with the plans, Sections **701, 702, 703, 709, 712**, and other sections that are pertinent to such prestressed members, except that this section shall govern where at variance from the other section or sections. Prestressing shall be of the pretensioning or post-tensioning type, or a combination of two methods, as required by the plans and special provisions.