1. September 3, 2020

REVISION OF SECTION 602

REINFORCING STEEL

**NOTICE**

This is a standard special provision that revises or modifies CDOT’s *Standard Specifications for Road and Bridge Construction.* It has gone through a formal review and approval process and has been issued by CDOT’s Project Development Branch with formal instructions for its use on CDOT construction projects. It is to be used as written without change. Do not use modified versions of this special provision on CDOT construction projects, and do not use this special provision on CDOT projects in a manner other than that specified in the instructions unless such use is first approved by CDOT’s Standards and Specifications Unit. The instructions for use on CDOT construction projects appear below.

Other agencies which use the *Standard Specifications for Road and Bridge Construction* to administer construction projects may use this special provision as appropriate and at their own risk.

**Instructions for use on CDOT construction projects:**

Use in projects having reinforcing steel.

**DESCRIPTION**

* 1. This work consists of furnishing and placing reinforcing steel in accordance with these specifications and in conformity with the plans.

# MATERIALS

* 1. Reinforcing steel and welded wire fabric that will be furnished either uncoated or coated shall meet the requirements of subsection 709.01.

The coating material for epoxy coated reinforcing shall be a light colored powdered epoxy resin which will highlight rusting of untreated bar areas.

Reinforcing steel that requires welding shall conform to ASTM A706. Welding shall be done in accordance with ANSI/AWS D1.4.

All accessories, including reinforcing steel supports, ties, and splicers used in conjunction with the reinforcing steel, shall be of the same, or compatible coating as the reinforcing utilized.

Reinforcing steel not identified on the plans as epoxy coated may be supplied as epoxy coated, at the Contractor's option, at no additional cost to the Department. Epoxy coated reinforcing steel may not be substituted for Stainless, Continuous Hot dipped Galvanized, Zinc Coated (Galvanized), and Chromium reinforcing alternatives.

Reinforcing alternatives such as: Stainless, Continuous Hot dipped Galvanized, Zinc Coated (Galvanized), and Chromium reinforcing may be supplied for reinforcing steel or epoxy coated reinforcing, at the Contractor's option, at no additional cost or time to the Department as approved by the Engineer.

Length of lap splices for reinforcing steel shall be in accordance with AASHTO *LRFD Bridge Design Specifications*, unless otherwise specified.

# CONSTRUCTION REQUIREMENTS

* 1. **Bar List.** Two copies of a list of all reinforcing steel and bending diagrams shall be furnished to the Engineer at the site of the work at least one week before the placing of reinforcing steel is begun. Such lists will not be reviewed for accuracy. The Contractor shall be responsible for the accuracy of the lists and for furnishing and placing all reinforcing steel in accordance with the details shown on the plans.

Bar lists and bending diagrams which are included on the plans, do not have to be furnished by the Contractor. When bar lists and bending diagrams are included on the plans, they are intended for estimating approximate quantities. The Contractor shall verify the quantity, size and shape of the bar reinforcement against those shown on the plans and make all necessary corrections before ordering.

* 1. **Protection of Materials.** Reinforcing steel and its coating shall be protected at all times from damage. When placed in the work, the reinforcing steel shall be free from dirt, loose mill scale, paint, oil, loose rust, or other foreign substance.
	2. **Bending.** Unless otherwise permitted, all reinforcing bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as shown on plans or permitted. Bars shall not be bent or straightened in a manner that will injure the material or the coating. Should the Engineer approve the application of heat for field bending reinforcing bars, precautions shall be taken to assure that the physical properties of the steel will not be materially altered.

Hooks and bends shall conform to the provisions of the AASHTO LRFD Bridge Design Specifications

Bars which are shown as “hooked” on the plans shall have “standard hooks” unless otherwise indicated. The term “standard hook” as used herein shall mean one of the following:

1. A 180-degree turn plus an extension of four bar diameters but at least 2½ inches at the free end of the bar, or
2. A 90-degree turn plus an extension of 12 bar diameters at the free end of the bar, or
3. For stirrup and tie anchorage only
	1. No. 5 bar and smaller, 90-degree turn plus an extension of six bar diameters at the free end of the bar.
	2. No. 6, 7, and 8 bar, 90-degree turn plus an extension of 12 bar diameters at the free end of the bar.
	3. No. 8 bar and smaller, 135-degree turn plus an extension of six bar diameters at the free end of the bar

The inside diameter of bend measured on the inside of the bar, other than for stirrups and ties, shall be as follows:

|  |  |
| --- | --- |
| **Bar Size** | **Grade 60** |
| No. 3 thru No. 8 | 6 bar dia. |
| No. 9, No. 10, and No. 11 | 8 bar dia. |
| No. 14 and No. 18 | 10 bar dia. |

The inside diameter of bend for stirrups and ties shall not be less than four bar diameters for sizes No. 5 and smaller, and five bar diameters for No. 6 to No. 8 inclusive.

Inside diameter of bend in welded wire fabric, smooth or deformed, shall not be less than four wire diameters for deformed wire larger than D6 and two wire diameters for all other wires. Bends with inside diameter of less than eight wire diameters shall not be less than four wire diameters from the nearest welded intersection.

* 1. **Placing and Fastening.** The minimum spacing center to center of parallel bars shall be 2½ times the diameter of the bar. However, the clear distance between the bars shall not be less than 1½ times the maximum size of the coarse aggregate or 1½ inches, whichever is greater.

Bundle bars shall be tied together at not more than 6 foot centers.

All reinforcement shall have a clear coverage of 2 inches, except as shown on the plans. Clear coverage shall be measured from the surface of the concrete to the outside of the reinforcement.

Reinforcement used in post-tensioned concrete shall be adjusted or relocated during the installation of prestressing ducts or tendons, as required, to provide location and planned clearances to the prestressing tendons, anchorages, jacks and equipment as approved by the Engineer.

All reinforcement shall be tied at all intersections except where spacing is less than 1 foot in each direction, in which case alternate intersections shall be tied.

In concrete bridge decks the upper mat of bars shall be tied to the lower mat of bars at 4 foot maximum spacing in each direction. Slab bolsters for the bottom mat and high chairs for the top mat shall each be placed at a maximum spacing of 4 feet on centers.

Welding on reinforcing bars will not be permitted except as noted on the plans. Reinforcement placed in any member shall be inspected and approved before any concrete is placed.

The placing, fastening, splicing and supporting of reinforcing steel and wire mesh or bar mat reinforcement shall be in accordance with the plans and the latest edition of “CRSI Recommended Practice for Placing Reinforcing Bars.” In case of discrepancy between the plans and the CRSI publication stated above, the plans shall govern. Automated tie wire devices may be used. The total cross-sectional area of the automated tie wire wrap shall roughly equal the total cross-sectional area of a manually installed tie wire wrap. The tie wire shall be epoxy coated or plastic coated for use with epoxy coated reinforcing steel. All epoxy coating on the reinforcing steel that is damaged from the use of automated tie wire devices shall be repaired at the Contractor’s expense.

Precast concrete blocking or other approved blocking material shall be used to support footing bars and bars in slabs on grade. All other reinforcing steel shall be supported with steel chairs or precast mortar blocks. All chairs coming in contact with forms shall be CRSI Class 1 or Class 2, Type B.

The location of splices, except where shown on the plans, shall be based upon using 60 foot stock length bars for No. 6 bars and larger and 40 foot stock length bars for No. 4 and No. 5 bars (this does not preclude the use of 60 foot). Minimum splice lengths are as shown on the plans. Where bars of different size are spliced together, the splice length for the smaller bar will govern.

Unless otherwise shown on the plans or approved, splices in adjacent lines of reinforcing bars shall be staggered. The minimum distance between staggered splices for reinforcing bars shall be the length required for a lapped splice in the bar.

Lapped splices will be permitted only at locations where the concrete section is sufficient to provide a minimum clear distance of 2 inches between the splice and the nearest adjacent bar. The clearance to the surface of the concrete shall not be reduced.

Reinforcing bars may be continuous at locations where splices are shown on the plans. Reinforcing bars No. 14 and No. 18 shall not be spliced by lapping, but shall be joined by butt welding in accordance with AWS D1.4 in such a way as to develop at least 125 percent of the specified yield strength of the bar in both tension and compression. Alternate systems of welding or mechanical butt splices may be submitted for approval.

**METHOD OF MEASUREMENT**

* 1. The weight of reinforcing steel for payment will not be measured but shall be the quantities designated in the Contract; except, measurements will be made for revisions requested by the Engineer, or for an error of plus or minus 2 percent of the total weight shown on the plans for each structure.

Prospective bidders shall verify the weight of reinforcing steel before submitting a proposal. Adjustment will not be made in the weight shown on the plans, other than for approved design changes or for an error as stipulated above, even though the actual weight may deviate from the plan weight.

The computed weight of coated reinforcing bars will be based on the nominal weight before application of the coating. Nominal weights for various bar sizes are shown below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Bar Size** | **Weight per Linear Foot (in Pounds** | **Bar Size** | **Weight per Linear Foot in Pounds** |
| ¼ inch | 0.167 | No. 8 | 2.670 |
| No. 3 | 0.376 | No. 9 | 3.400 |
| No. 4 | 0.668 | No. 10 | 4.303 |
| No. 5 | 1.043 | No. 11 | 5.313 |
| No. 6 | 1.502 | No. 14 | 7.650 |
| No. 7 | 2.044 | No. 18 | 13.600 |

**BASIS OF PAYMENT**

**602.8** The accepted quantities of reinforcing steel will be paid for at the contract unit price per pound. No allowance will be made for supports, clips, wire or other material used for fastening reinforcement in place.

Payment will be made under:

|  |  |
| --- | --- |
| **Pay Item** | **Pay Unit** |
| Reinforcing Steel Pound | Pound |
| Reinforcing Steel (Epoxy Coated) | Pound |
| Reinforcing Steel (Galvanized) | Pound |
| Reinforcing Steel (Stainless) | Pound |
| Reinforcing Steel (High Performance) | Pound |