MINNESOTA

DEPARTMENT OF TRANSPORTATION

ST. PAUL, MINNESOTA

STANDARD SPECIFICATIONS FOR CONSTRUCTION

2018 EDITION

(1) Before shipping, legibly mark material according to the field erection plan, and as approved by the Engineer;
(2) Place markings on the "inside" of fascia beams on a bridge;
(3) Mark duplicate pieces unless otherwise approved by the Engineer;
(4) Bolt connection plates for members in position for shipment;
(5) Ship pins, bolts, nuts, and washers in weatherproof containers no greater than 500 lb. Ship pins with nuts in place;
(6) Package bolts of the same length and diameter, nuts, and washers meeting the requirements of ASTM F3125, "Packaging and Package Instructions";
(7) Pad coated material to keep the material clean and undamaged during loading, transporting, unloading, handling, and storage;
(8) Ship beams and girders in an upright position, unless otherwise approved by the Engineer. Block material to prevent buckling, warping, or twisting during transportation; and
(9) Block cambered members to prevent loss of camber.

2472 METAL REINFORCEMENT

2472.1 DESCRIPTION

This work consists of providing and placing metal reinforcement of the types, shapes, and sizes as required by the contract.

2472.2 MATERIALS

2472.3 CONSTRUCTION REQUIREMENTS

A Bending

Bend bars to the shapes as shown on the plans. The Contractor may bend the bars cold. If hot bending a non-coated bar, do not heat bars to temperatures greater than 1,200° F and do not quench the bars.

Bar bending details shall conform to the American Concrete Institute 315, "Details & Detailing of Concrete Reinforcement," unless otherwise shown or noted in the plans. Ensure that the bar bend diameters are as shown "Recommended" in the American Concrete Institute 315.

Repair bond loss or coating damage after bending epoxy coated reinforcement bars in accordance with 3301, "Reinforcement Bars." Clean damaged areas to remove loose or deleterious material before patching. Remove rust by blast cleaning. The Engineer, in conjunction with the Materials Engineer, will not require the repair of hairline cracks with no bond loss or other damage. Perform repairs before oxidation appears.

B Storage and Protection

Do not store metal reinforcement in a manner that will cause, induce, or accelerate corrosion or contamination of the metal. Locate timbers (dunnage) on the ground to support the bundles and keep them free of contamination. Store materials at the project site to allow the Engineer to visually inspect and check the various types of reinforcement for conformance to the dimensions as shown on the plans. Store bars of the same type together. Identify reinforcement bars with tags bearing the identification symbols as shown on the plans.

Protect coated reinforcement bars before handling or shipping to prevent damage to the coating. Pad bundling bands and lift bundles using an OSHA-approved spreader bar, multiple supports, or platform bridge to prevent bar-to-bar abrasion from sags in the bar bundle. Do not drag or drop bars or bundles. Support bars or bundles in transit to prevent damage to the coating.

If the epoxy-coated reinforcing steel is incorporated into the Project and is exposed to the weather or stored exposed to the weather for more than 60 calendar days, cover the steel to protect the material from sunlight, salt-spray and weather exposure. Provide for air circulation around the covered steel to minimize condensation under the protective covering.

C Placing, Supporting, and Tying Bar Reinforcement

C.1 General Requirements

Before placing concrete in a unit, ensure the reinforcement bars meet the condition defined in the current CRSI manual titled *Placing Reinforcing Bars,* Chapter VII, "Unloading, Storing, and Handling Bars on the Job." Place the bars as specified in "Tolerances in Placement" section in Chapter X, "General Principles for Bar Placing, Splicing and Tying Reinforcing Bars."

Carefully place the beam seat/pedestal reinforcement to avoid interference with drilling holes for fixed bearing anchor rods. Provide a template demonstrating that the anchor rods have a 2 inch clear distance to all reinforcement for the entire embedment at all bearing anchor rod locations. Confirm the proper clearance to the reinforcement with the Engineer prior to placing the affected substructure concrete. Place the beam or girder in its final position prior to drilling or coring holes for the anchor rods. If reinforcement steel is encountered during the drilling or coring process, contact the Engineer, and the Engineer will determine how to proceed. Verify the depth of the holes in the presence of the Engineer prior to inserting the anchor rods.

Firmly support and securely tie reinforcement bars in their proper position. Tie all outermost intersections, and enough of the intermediate intersections, to ensure that no shifting or displacement of the bars will occur during subsequent operations. Bar supports are intended to support the steel reinforcement and normal construction loads; and are not intended to, and should not be used to, support runways for concrete buggies or similar loads. Use black, soft iron wire of at least 16 gauge for tying the reinforcement bars. Do not use welded ties. Do not place concrete before the Engineer inspects and approves the placement, support system, and ties for the reinforcement bars.

Provide supports with the following characteristics for reinforcement bars bearing on the falsework sheathing for exposed concrete surfaces:

(1) Stainless steel;
(2) Hot-dip galvanized, epoxy, vinyl, or plastic coated tips extending at least ½ inch above the sheathing; or
(3) Plastic.

The wire coating shall not chip, peel, crack, or distort under any job conditions and temperatures.

C.2 Special Requirements for Bridge Slabs

Support and tie reinforcement bars for bridge slabs in accordance with the General Requirements and the maximum spacing requirements specified in Table 2472-1. These spacing requirements define only the maximum permissible distances between ties or lines of support. Table 2472-1 does not relieve the Contractor of responsibility for providing additional supports or ties for holding and supporting bars firmly in their correct position.

For bridge slabs, use slab bolsters as the primary support for the bottom transverse reinforcement bars meeting the requirements of "Bar Support Specifications and Standard Nomenclature" in the *CRSI Manual of Standard Practice.* Place the bolsters on the falsework sheathing in continuous lines, parallel to the beams, girders, or centerline of the roadway at locations that will permit placement of supports for the top transverse reinforcement bars directly over the bolsters on the bottom transverse bars.

Use continuous lines of upper continuous high chairs with wire runners as the support system for the top transverse reinforcement bars. Place the high chairs to transfer load to the bottom bolsters without causing deflection in the bottom transverse bars. Use individual type high chairs only as supplemental support or for sections where the use of continuous type high chairs is not practical and the Engineer approves, in writing, the use of the individual type high chairs.

For all interior bays on beam span bridges, place slab bolsters and upper continuous high chairs within 6 inches of the edge of beam flanges.

Use tie wires to tie down the top mat of bridge slab reinforcing to the in-place beam stirrups or shear connectors at spacing no greater than 5 ft, as measured longitudinally along each beam.

If the support system specified in this section is not practical, the Contractor may propose an alternative support system for slab span bridges or other special designs. Provide working drawings showing the proposed support system to the Engineer. If approved by the Engineer in writing, the Contractor may use the proposed support system.

Table 2472-1
Maximum Spacing of Supports and Ties for Bridge Slabs

Bar Size Number	Maximum Spacing for Slab Bolsters and Continuous Type High Chairs, *ft*
3 and 4	3.00
5, 6, and 7	4.00

Support the bottom layer of longitudinal reinforcement bars for slab span bridges, cast-in-place concrete girders, beams, struts, and similar sections on beam bolsters or heavy beam bolsters commensurate with the mass to be supported. Do not use precast concrete block or brick supports on formed surfaces.

Use the upper beam bolsters or the upper heavy beam bolsters to support subsequent layers of longitudinal bottom reinforcement, except for bars that can be tied to vertical bars, unless otherwise approved by the Engineer.

After the completion of the placement and tying of the reinforcement bars for a section of bridge slab, and before ordering concrete delivery for that section, set the strike-off rails or guides to the correct elevation. Notify the Engineer when the section is ready for a final check. Operate the strike-off device over the entire section in the presence of the Engineer. Attach a filler strip, ¼ inch less in thickness than the minimum concrete cover requirement, to the bottom of the strike-off during this check to detect areas where the top reinforcement may encroach on the required clearance. Do not place concrete for a bridge slab before the Engineer inspects and approves the deck grades.

Tie the top mat of epoxy-coated reinforcement bars at every transverse bar intersection along each continuous row of longitudinal bars. Tie the bottom mat of reinforcement bars and non-continuous rows of top mat bars at least at every second transverse bar intersection. Stagger the ties for the bottom mat along adjacent rows of longitudinal bars. Use plastic or nylon-coated tie wires.

Use plastic bar supports or epoxy-coated wire bar supports with coating resistant to abrasion. Provide epoxy coating for bar supports at least 0.005 inch thick and in accordance with 3301, "Reinforcement Bars." Provide plastic coated tips or additional epoxy coating on the legs of the supports for wire bar supports that bear on falsework sheathing for exposed concrete surfaces. Ensure the additional material extends at least ½ inch above the sheathing, not including portions of the supports other than the legs. Use a grey-colored coating with a total coating thickness on the ½ inch portion, including the initial 0.005 inches of epoxy coating, of at least $^{3}/_{32}$ inch. Use incompressible and abrasion resistant plastic or epoxy material.

C.3 Special Requirements for Coated Bars

The Engineer will not require the Contractor to repair damage caused during shipment of coated bars or by the installation procedures if the damaged area is no greater than ¼ inch × ¼ inch and the sum of damaged areas in each 1 ft length of bar is no greater than 2 percent of the bar surface area. Repair damage greater than ¼ inch × ¼ inch as recommended by the manufacturer. The Engineer will reject bars with total damage greater than 2 percent of bar surface area. Remove rejected bars. Ensure the total bar surface area covered by patching material is no greater than 5 percent.

Do not flame cut coated reinforcing bar in any application.

If using an abrasive blade to cut epoxy-coated reinforcing bar and the cut ends are properly coated with a two-part epoxy patching material as recommended by the manufacturer of the epoxy coating, the Department will allow cutting of epoxy-coated bars.

Use a non-metallic vibrator head to consolidate the concrete around coated reinforcement bars and other components.

D Splicing Metal Reinforcement

Provide reinforcement in the lengths shown on the plans. Do not place splices unless otherwise shown on the plans or approved in writing by the Engineer. Place field splices at locations and with details as approved by the Engineer.

D.1 Lap Splices

Provide lap splices as shown on the plans. If not shown on the plans, provide bar reinforcement lap lengths per table 2472-2, "Length of Bar Splices."

Table 2472-2
Length of Bar Splices

U.S. Customary Bar Size	Diameter		Number of Diameters	Length of Splice, *inches*
	Fraction *inches*	Decimal *inches*		
3	$^{3}/_{8}$	0.375	36	14
4	$^{1}/_{2}$	0.500		18
5	$^{5}/_{8}$	0.625		23
6	$^{3}/_{4}$	0.750		27
7	$^{7}/_{8}$	0.875		32
8	1	1.000	40	40
9	$1\text{-}^{1}/_{8}$	1.128		45
10	$1\text{-}^{1}/_{4}$	1.270		51
11	$1\text{-}^{3}/_{8}$	1.410		56