Specifications for epoxy-coated reinforcing bars

Concrete Reinforcing Steel Institute suggests standard specifications for use in project documents

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Recently, the Concrete Reinforcing Steel Institute (CRSI) issued a set of suggested project specifications provisions for epoxy-coated reinforcing bars.* The end-use provisions are intended to be compatible with any American Concrete Institute (ACI), American Association of State Highway and Transportation Officials (AASHTO), or American Railway Engineering Association (AREA) requirements that might already be a part of a given set of job specifications.

These CRSI provisions could be readily entered verbatim into the job specifications for projects where epoxy-coated reinforcing bars are to be used. Such projects might be transportation structures, parking garages, port and marine structures, or wastewater treatment plants. Engineering judgment could nevertheless be used to modify the requirements for certain structures or parts of structures. For example, the limits for permissible coating damage might be increased for epoxy-coated bars in the walls of sewage treatment plants, since such structures are not subjected to the repetitive moving loads and frequent applications of deicing salts that bridges experience.

Many of the basic specification requirements for uncoated bars are also applicable to epoxy-coated bars. Examples are preparation, submittal and acceptance of placing drawings; fabrication (standard hooks and typical bar bends); fabricating tolerances; placing tolerances; and overall requirements for splices.

The CRSI “Suggested Provisions for Epoxy-Coated Reinforcing Bars for Inclusion in Project Specifications” are given on page 810. In the commentary that follows, the section numbers correspond to the section numbers in those “Suggested Provisions.”

Discussion of suggested provisions

General. The project specifications should include the year of issue of each of the ASTM specifications referred to. These can be determined by checking the latest Annual Book of ASTM Standards, Volume 01.04, published by the American Society for Testing and Materials.

1.1 The provisions for the reinforcing bars in this section follow the requirements of the 1983 ACI Building Code, ACI 318, “Building Code Requirements for Reinforced Concrete.” The specifications of many state and federal government agencies and others currently have similar requirements or presumably will have them. Note that billet-steel bars must also meet the supplementary requirement S1 of ASTM A 615, “Standard Spec-
SUGGESTED PROVISIONS FOR EPOXY-COATED REINFORCING BARS FOR INCLUSION IN PROJECT SPECIFICATIONS
As given in CRSI Engineering Data Report Number 19

1. REINFORCEMENT

1.1 Reinforcing bars—All reinforcing bars shall be deformed, except that plain bars may be used for spirals. Reinforcing bars shall be the grades required by the Contract Documents and shall conform to one of the following specifications:

1.1.1 ASTM A 615 including supplementary requirements S1.

1.1.2 ASTM A 616, except that all bars shall be bend-tested and shall meet the bend-test requirements for axle-steel reinforcing bars, ASTM A 617, Grade 60; and the bar markings rolled into the surface of the bars shall include the letter R to designate rail steel meeting these requirements.

1.1.3 ASTM A617.

1.1.4 ASTM A 706.

1.2 Epoxy-coated reinforcing bars—When specified by the Engineer/Architect, epoxy-coated reinforcing bars shall conform to ASTM A 775. The reinforcing bars to be epoxy-coated shall conform to Section 1.1.

1.2.1 Repair of damaged epoxy coating—When required, damaged epoxy coating shall be repaired with patching material conforming to ASTM A 775. Repair shall be done in accordance with the patching material manufacturer’s recommendations.

1.3 Bar mats

1.3.1 Bar mats shall conform to ASTM A 184 and shall be fabricated from reinforcing bars that conform to Section 1.1.

1.3.2 Bar mats may be fabricated from epoxy-coated reinforcing bars. Metal clips shall be epoxy-coated. Nonmetallic clips may be used. Coating damage at the clipped or welded intersections shall be repaired in accordance with Section 1.2.1.

2. FABRICATION

2.1 All reinforcement shall be bent cold unless otherwise permitted by the Engineer/Architect.

3. PLACING (FIELD INSTALLATION)

3.1 Epoxy-coated reinforcing bars supported from formwork shall rest on coated wire bar supports, or on bar supports made of dielectric material or other acceptable materials. Wire bar supports shall be coated with dielectric material for a minimum distance of 2 inches from the point of contact with the epoxy-coated reinforcing bars. Reinforcing bars used as support bars shall be epoxy-coated. In walls having epoxy-coated reinforcing bars, spreader bars where specified by the Engineer/Architect shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material.

3.2 Epoxy-coated reinforcing bars shall be fastened with nylon-, epoxy-, or plastic-coated tie wire or other acceptable materials.

3.3 Splices of reinforcing bars shall be made only as required or permitted by the Contract Documents, or as authorized by the Engineer/Architect.

3.3.1 Welded splices—When required or permitted, all welding of reinforcing bars shall conform to AWS D14. Unless otherwise permitted, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.

3.3.2. Suitable ventilation shall be provided when welding epoxy-coated reinforcing bars.

3.3.3 After completion of welding on epoxy-coated reinforcing bars, coating damage shall be repaired in accordance with Section 1.2.1. All welds, and all steel splice members when used to splice bars, shall be coated with the same material used for repair of coating damage.

3.3.4 Mechanical connections—When required or permitted, mechanical connections shall be installed in accordance with the splice device manufacturer’s recommendations.

3.4 Reinforcing bars partially embedded in concrete shall not be field bent, except as indicated on the Contract Documents or permitted by the Engineer/Architect. When heat is used to field bend epoxy-coated reinforcing bars, suitable ventilation shall be provided. When epoxy-coated reinforcing bars are field bent, coating damage shall be repaired in accordance with Section 1.2.1.

3.5 Unless permitted by the Engineer/Architect, reinforcing bars shall not be cut in the field. When epoxy-coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

3.6 Epoxy-coated reinforcing bars—Equipment for handling epoxy-coated bars shall have protected contact areas. Bundles of coated bars shall be lifted at multiple pickup points to minimize bar-to-bar abrasion from sags in the bundles. Coated bars or bundles of coated bars shall not be dropped or dragged. Coated bars shall be stored on protective cribbing. Fading of the color of the coating shall not be cause for rejection of epoxy-coated reinforcing bars. Coating damage due to handling, shipment and placing need not be repaired in cases where the damaged area is 0.1 square inch or smaller. Damaged areas larger than 0.1 square inch shall be repaired in accordance with Section 1.2.1. The maximum amount of damage including repaired and un repaired areas shall not exceed 2 percent of the surface area of each bar.
ification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.”

Also note the special bend test requirements for rail-steel bars. For reinforcing bars, the type of steel and grade (minimum yield strength) must be specified in the Contract Documents for all projects.


Since this report is concerned only with epoxy-coated reinforcing bars, the other kinds of reinforcement such as wire and welded wire fabric are not included in Section 1.1.

1.2 This section gives the provisions for specifying epoxy-coated bars and, when required in subsequent sections, the provisions for repair of damaged coating. To meet the ACI Building Code and other codes and specifications, the bars that are to be coated must meet the requirements in Section 1.1. This is another reason for including the specific requirements for reinforcing bars in these suggested provisions, particularly for billet- and rail-steel bars. ASTM A 775, “Standard Specification for Epoxy-Coated Reinforcing Steel Bars,” does not include the additional requirements for billet- and rail-steel bars which are given in Sections 1.1.1 and 1.1.2, respectively.

On projects where both uncoated and epoxy-coated reinforcing bars are used, the Engineer/Architect should be precise in identifying those bars that are to be coated.

1.3 The current ASTM A 184, “Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement,” does not include epoxy-coated bars. It is anticipated that ASTM A 184 will be revised soon. Until that revision is accomplished, Section 1.3.2 of the “Suggested Provisions” provides for mats fabricated from coated bars. ASTM A 184 permits fabrication of mats by clipping or welding the bar intersections. For certain applications the Engineer/Architect may wish to restrict the fabrication of bar mats to the clipped type only.

2.1 ASTM A 775 (title given above) contains provisions for repair of coating damage resulting from fabrication. The reason for including Section 2.1 is to emphasize that all reinforcing bars, uncoated and coated, must be bent cold unless otherwise permitted.

3.1 As pointed out in CRSI Engineering Data Report Number 14 (and in our article based on it cited in the footnote on page 809—Editor), there have been reports of problems and misunderstandings in furnishing bar supports for epoxy-coated bars because of the apparent lack of specifications. The suggested provisions in Section 3.1 are intended to clarify the issue of bar supports. If epoxy-coated reinforcing bars are required for both the top and bottom mats in slabs or bridge decks, for example, the entire wire bar support should be coated.

Detailing of side form spacers is not a standard requirement and is performed only when specifically required by the Contract Documents (see ACI Committee 315, “ACI Detailing Manual, 1980,” Publication SP-66, published by American Concrete Institute). Thus the Engineer/Architect must specify side-form spacers including material, coating (if required), type, spacing and location where required.

3.2 To minimize damage, or cutting into the bar coating, some type of coated tie wire should be used for tieing assemblages of epoxy-coated bars.

3.3 This section contains provisions for welded splices and mechanical connections of coated bars. The current AWS D 1.4 “Structural Welding Code—Reinforcing Steel” (published by American Welding Society) contains a safety precaution for welding zinc-coated (galvanized) reinforcing bars but not for epoxy-coated bars. Odors and fumes result from heating and welding epoxy-coated bars. For this reason it is prudent, until the welding code is revised, to include a suggested clause that suitable ventilation (Section 3.3.2) be provided.

AWS D 1.4 does not permit welding of crossing bars for assembly of reinforcement (tack welding) unless authorized by the Engineer. However, it is recommended that this prohibition be emphasized in the project specifications by including Section 3.3.1 in them. A CRSI reference states: “Never permit field welding of crossing bars (‘tack’ welding, ‘spot’ welding and so forth). Tie wire will do the job without harm to the bars.” (Reinforcement Anchorage and Splices, Second edition, 1984, Concrete Reinforcing Steel Institute.)

For certain types of splice devices, the supplier might prefer to coat the steel splice sleeves and other parts of the mechanical connections with the same coating material, applied by the same method, as used for the epoxy-coated reinforcing bars. This practice might be more cost effective, especially for larger projects, and would certainly be acceptable.

3.4 If coated bars partially embedded in concrete are field bent, the damaged coating must be repaired in accordance with Section 1.2.1. Guidelines for field bending of bars partially embedded in concrete are given in ACI 318MR, “Commentary on Building Code Requirements for Reinforced Concrete.” If heat is used for such field bending, as suggested by the Commentary, it is prudent to include a provision requiring ventilation when epoxy-coated bars are heated, as was discussed above for welding.

3.5 Field cutting of reinforcing bars, whether uncoat-
ed or coated, should be done only if permitted by the Engineer/Architect. If epoxy-coated reinforcing bars are field-cut, the ends of the bars must be coated with patching material.

3.6 These suggested provisions are intended to minimize coating damage during handling and field placing operations, and to set limits on permissible coating damage and repair of damaged coating. The permissible coating damage is compatible with the requirements of ASTM A 775 for coating damage suffered in fabrication or handling to the point of shipment. Similarly, the limit on the maximum amount of damage, including repaired and un repaired areas, is compatible with the same specification. As reported in CRSI Engineering Data Report Number 14, some epoxy coatings may fade in color when the coated bars are exposed to sunlight over a period of time. Since this fading does not harm the coating, a provision is included to clarify the fact.

Editor's note:
This article is condensed from “Suggested Project Specifications Provisions for Epoxy-Coated Reinforcing Bars,” CRSI Engineering Data Report Number 19. Copies of that report and other CRSI publications referred to in this article are available from Concrete Reinforcing Steel Institute, 933 North Plum Grove Road, Schaumberg, Illinois 60195.

Sources of other documents referred to in this article are: American Concrete Institute, Box 19150, Detroit, Michigan 48219; American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103; and American Welding Society, 2501 N.W. Seventh Street, Miami, Florida 33125.

Coated bars should be stored on protective cribbing. Nylon straps are used in bundling bars to avoid damaging the bar coating.