

03200 CONCRETE REINFORCEMENT

SPECIFIER:

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PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the latest edition of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI 117 Tolerances for Concrete Construction and Materials.
2. ACI 301 Specifications for Structural Concrete for Buildings.
3. ACI 315 Details and Detailing of Concrete Reinforcement.
4. ACI 318 Building Code requirements for Reinforced Concrete.
5. ACI 439.3R Mechanical Connection of Reinforcing Bars.
6. AWS D1.4 Structural Welding Code Reinforcing Steel.
7. CRSI, Manual of Standard Practice.
8. CRSI, Placing Reinforcing Bars.
9. Wire Reinforcement Institute, Manual Standard Practice.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM), latest edition:

1. A82 Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. A184 Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. A185 Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
4. A496 Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. A497 Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
6. A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
7. A775 Specification for Epoxy-Coated Reinforcing Steel Bars.
8. C1116 Specification for Fiber-reinforced Concrete and Shotcrete.

1.3 SUBMITTALS

- A. General:

1. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement.
 - a. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement and accessories.
 - b. Include special reinforcement required at openings through concrete structures.

2. Shop drawings made from sepias (or other reproductive methods) of the structural drawings will not be accepted and shall be cause for resubmittal.
- B. Selection of splices: Splices shall be full tension, unless noted otherwise.
1. Splices noted on the drawings to be compression splices shall be furnished by one of the following:
 - a. Compression lap splices according to ACI 315.
 - b. Mechanical compression only connectors according to ACI 439-3R, staggered 1/2 Class "C" lap length and maintaining not less than 1/4 the total tensile capacity of any column face.
 - c. Full penetration welds staggered not less than 18 diameters.
 2. Splices shown on the drawings as either Class "A" or Class "B" may be one of the following:
 - a. Class "B" lap splices.
 - b. Class "A" (but not less than compression lap) lap splices staggered not less than one Class "B" lap length.
 - 1) Exception: This shall not be allowed when shown as class "B" in a location, which by design, has already accounted for other continuing bars or staggered splices.
 - c. Appropriate mechanical connectors according to ACI 439-3R staggered not less than 24 diameters.
 - d. Full penetration welds staggered not less than 24 diameters.
 3. Unless otherwise noted in the drawings, reinforcing shall be spliced to develop the full strength of the bar in either tension or compression. Those splices shall be furnished by one of the following:
 - a. Class "B" lap splices where only 1/2 of the total rebars are spliced at any one floor.
 - b. Full penetration welds staggered not less than 36 diameters.
 - c. Appropriate mechanical connectors according to ACI 439-3R staggered not less than 36 diameters.
 4. Total steel at lap splices shall not exceed 8 percent for columns or shear wall cores containing the spliced bars.
 - a. All bars may be lapped at one section for up to 4 percent steel.
 - b. 1/2 of the bars may be lapped for up to 5.3 percent steel.
 - c. 1/3 of the bars may be lapped for up to 6 percent steel.
 - d. Above 6 percent steel, other splice choices shall be used.
 5. Where staggered lap splices are used, provide a mixture of bar sizes as appropriate where vertical bar size changes on the drawings.
 6. Where different size bars are lap spliced, the length of splice may be based on the smaller bar size. If there is a larger quantity of the smaller bar size, the splice length shall be based on the larger bar.

7. It shall be the responsibility of the reinforcing detailer to determine the concrete strength at the point of a lap splice, the bar position (top or other), bar spacing, confinement condition based on ties or stirrups or edge condition to select the proper lap length.
 8. Increase laps for bundled bars according to ACI 318, with number based on total bars in group including lapped bars.
- C. Detailing of Splices: Placing shop drawings shall specifically show splice lap lengths where they occur. Bar diameter lap tables and references to other charts are not acceptable.
- D. Staggered Laps Required: Provide staggered laps in any member as necessary to keep space between bars within splice zone at least 1 inch or 1 bar diameter clear.
- E. Detailing of Bar Placement: For any bar other than those placed at an edge condition, between edge condition or openings, or any other location where the bar cannot be shifted longitudinally, a dimension shall be shown from an identifiable building grid, wall, or edge to at least one end of the bar.
- F. Congested Areas of Placement: For any conditions resulting in bar spacing less than 2 diameters clear or where the placement of bars in one member requires critical templating to allow bar placement in an intersecting member, furnish details of sufficient scale to show clearances, spacing, and arrangements for properly placing those bars.
- G. Accessories: Show accessories, supports, chairs, bolsters, and spacers necessary to complete the installation. Where supports are beyond the scope of CRSI detailing standards and custom designed supports are required, provide engineering calculations demonstrating the capacity of the system.
- H. Flat Plates: Provide not less than 3 separate drawings of each plate separately showing bottom bars, top bars, and accessories.
- I. Welding Submittals:
1. If welding of reinforcing bars is to be included as part of the work, submit the following:
 - a. A complete welding procedure specification according to AWS D1.4.
 - b. A certified chemical analysis of the steel to be welded.
 - c. Carbon equivalence calculations according to AWS D1.4.
 - d. Qualification papers for welders who will be employed on the project. Welders shall have passed a qualification test within a 12 month period before the work or furnish a statement from a testing agency acceptable to A/E that they have observed or tested that welder's work under similar requirements within the past 6 months.

1.4 SUBSTITUTIONS

A. Reinforcing Splicing:

1. Splices shown in the drawings shall be considered mandatory for base bid purposes.
2. Alternative methods of providing for splices are available within the constraints of this specification and ACI 318.
3. If alternative splices are desired, the shop drawing submitted shall clearly indicate the change and include authorization by any other subcontractors involved in the change.

PART 2 PRODUCTS

2.1 REINFORCING MATERIALS

- A. Comply with Chapter 5 of ACI 301.
- B. Reinforcing Steel:
 - 1. Bars #3 through #11 shall be deformed bars according to ASTM A615 Grade 60 and according to the additional requirements of Paragraph 5.2.2.1 of ACI 301.
 - 2. Bars #2 in size shall be plain round meeting A615/A-96a Grade 40.
 - 3. Welded wire fabric shall be of plain wire. Welded wire fabric shall be galvanized at exterior exposed concrete.
 - 4. Unless indicated otherwise the minimum concrete protective cover specified in Paragraph 5.7.1 of ACI 301 is the specified cover for this project unless indicated otherwise.
- C. Epoxy-Coated Reinforcing Bars: ASTM A775.
- D. Form-Saving Splice Connectors: Flanged devices to allow insertion of threaded reinforcing bars into a previously formed face. Available products include, but are not limited to:
 - 1. Form Saver by Lenton.
 - 2. DB-SAE Splices System by Dayton Superior.
 - 3. Rebar Flange Coupler by Williams Form Engineering Corp.
- E. Mechanical Connectors and Splice Devices: Proprietary products suitable for the use intended and listed in ACI 439-3R-83.
- F. Steel Wire: ASTM A82, plain, cold-drawn, steel.
- G. Fabricated Deformed Steel Bar Mats: ASTM A184.
- H. Welded Steel Wire Fabric: ASTM A185.
- I. Deformed Steel Wire: ASTM A496.
- J. Welded Deformed Steel Wire Fabric: ASTM A497.
- K. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI Class C or Class A as required acceptable.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces and with legs of supports in contact with forms, provide supports with legs, either plastic protected according to CRSI, Class 1 or stainless steel protected according to CRSI, Class 2.
 - 3. Provide custom supports as required to support top layer of mats and other special conditions not provided for within CRSI standards.
- L. Fiber Reinforcement:

1. Manufacturers:
 - a. Fibermesh by Protex
 - b. Forta-Ferro by Forta Corporation, Grove City, PA.
2. Comply for use in plain concrete as defined in ACI 318.1. and the following:
 - a. Fibers shall not be used as a replacement for any reinforcement required for structural purposes.
 - b. Blend fibers into the concrete mix according to manufacturer's written instructions.
 - c. Provide control joints according to Section 5.2 of ACI 318.1.
 - d. Fibers shall comply with ASTM C1116-95.

PART 3 EXECUTION

3.1 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as specified.
- B. Clean reinforcement of loose rust and mill scale, dirt, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required.
- D. When any reinforcing bar is placed projecting either horizontally or vertically from a given element to subsequently lap with other reinforcing bar, verify the detailed lap length will be achieved.
 1. Report any deviation to the A/E for correction before placing concrete in the first element.
 2. Bar projections resulting in laps shorter than the detailed laps shall be considered rejected, and corrective measures shall be taken at the direction of the A/E with no additional cost to the Board.
- E. Place reinforcement to obtain at least minimum coverages for concrete protection.
 1. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
 2. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- F. Install welded wire fabric in as long lengths as practicable.
 1. Lap adjoining pieces at least one full mesh plus 2 inches and wire splices.
 2. Offset end laps in adjacent widths to prevent continuous laps in either direction.

- G. Provide the A/E with not less than 48 hours notice before starting any welding of reinforcing bars.
1. Welding of reinforcing bars shall only be allowed under the direct supervision of the A/E.
 2. Welding of crossing reinforcing bars is not allowed.
 3. Any bars with unauthorized or unacceptable welds shall be replaced at no additional cost to the Board.

END OF SECTION