SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SCOPE

A. These specification provisions govern materials, fabrication, placement, and inspection of steel reinforcement and reinforcement supports.

1.2 RELATED SECTIONS

Section 03 10 00	Concrete Forming and Accessories
Section 03 30 00	Cast-in-Place Concrete
Section 31 63 29	Drilled Concrete Piers

1.3 REFERENCED CODES AND STANDARDS

A. Standards and References listed below apply where designation is cited in this Section. Where applicable year of adoption or revision is not listed below, the latest edition applies.

B. San Francisco Building Code (SFBC) 2019

C. American Concrete Institute (ACI) Standards

1. 117 – Specifications for Tolerances for Concrete Construction and Materials
2. 301– Specifications for Structural Concrete
3. 318– Building Code Requirements for Structural Concrete
4. SP-66 – ACI Detailing Manual

D. AWS - American Welding Society

1. D1.4 – Structural Welding Code – Reinforcing Steel, Latest Edition

E. American Society for Testing and Materials (ASTM) Standards, latest edition

1. A82/A82M – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
2. A185/A185M– Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
3. A496/A496M– Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
4. A497/A497M– Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
5. A615/A615M– Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
6. A706/A706M– Standard Specification for Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

F. Concrete Reinforcing Steel Institute (CRSI)

1. CRSI MSP-2-01 – Manual of Standard Practice, 28th edition

1.4 SUBMITTALS

A. Submittals shall be in accordance with Division 1.

B. Shop Drawings:

1. Contractor shall submit the reinforcing steel shop drawings to City Representative for review and approval, prepared in accordance with ACI SP-66, showing list of materials, sizes, dimensions, cutting, bending, placement details, and splicing and lapping.

2. Contractor shall coordinate with architectural, structural, mechanical, and electrical Contract Drawings for the location of anchors, bolts, inserts, conduits, sleeves, and any other embedded items, which are required to be cast in concrete. Contractor shall make all necessary provisions as required for the reinforcing steel that will not interfere with the placement of the embedded items.

3. Reinforcing steel shall not be fabricated or placed before the shop drawings are reviewed and approved by the City Representative, and returned to the Contractor. Such review does not relieve the Contractor from the full responsibility for both the accuracy of the shop drawings, and the accurate and complete placing of the work.

4. Shop drawings shall not be reproductions of the Contract Documents, nor shall they use or incorporate reproductions of parts of the Contract Documents.

C. Mill Test Reports: Certified mill test reports (tensile and bending), for each heat or melt of steel, showing physical and chemical analyses, shall be submitted to the City Representative for review and approval before the material delivery to the job site. Where reinforcing is required to be welded, mill test reports shall verify the use of weldable steel (ASTM A706).

1.5. QUALITY CONTROL

A. The Contractor is responsible for the quality control of the Work.

B. Allowable tolerances shall be in accordance with the requirements of ACI 117 and ACI 318 unless otherwise noted on Contract Drawings or specified.

1.6. QUALITY ASSURANCE

A. Maintain copies of all applicable Codes and Standards at the project site at all times.

B. Concrete reinforcement work shall be in accordance with CRSI Manual of Standard Practice and ACI SP-66 and shall conform to ACI 117 and ACI 318. Also see paragraph 3.06 for reinforcing steel special inspection requirements.

1.7. SPECIAL INSPECTION

A. An independent special inspection and testing agency will perform special inspections and field quality control tests as required in the Statement of Special Inspections noted

in the Contract Drawings. This does not preclude the Contractor's responsibility for inspections by the Contractor's Testing Agency.

1.8 DELIVERY, STORAGE AND HANDLING

A. Reinforcement shall be shipped and stored with reinforcement of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same designations as shown on the submitted placing drawings.

B. Reinforcement shall be stored off the ground and be protected from moisture. Keep free from soil, oil, or other injurious contaminants. All steel, which cannot be properly identified, will be rejected, and shall be immediately removed from the job site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing bars: Reinforcing bars shall be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.

1. Reinforcing bars shall conform to ASTM A615, Grade 60, unless otherwise indicated.

2. Reinforcing bars shall be ASTM A706, Grade 60 where welding is required.

B. Wire: Use plain or deformed wire as indicated in the Contract Drawings. Plain wire may be used for spirals.

1. Plain wire shall conform to ASTM A82.

2. Deformed wire size D4 and larger shall conform to ASTM A496.

C. Welded Wire Reinforcement: Use welded wire reinforcement as indicated in the Contract Drawings.

1. Plain welded wire reinforcement shall conform to ASTM A185, with welded intersections spaced no greater than 12 inches apart in direction of principal reinforcement.

2. Deformed welded wire reinforcement shall conform to ASTM A497, with welded intersections spaced no greater than 16 inches apart in direction of principal reinforcement.

D. Mechanical Couplers: Mechanical couplers shall be Type 2 and shall be capable of developing 125% of the specified yield strength and the ultimate tensile strength of the reinforcing bar.

2.2 ACCESSORIES

A. Tie wire: Minimum 16 gage black annealed wire.

B. Supports and spacers: Provide spacers, chairs, bolsters, and other devices to support and secure the reinforcement in place. Use plastic tip chairs for exposed finished concrete surfaces. Supports for reinforcing bars on ground, aggregate base or sand over vapor barrier shall be precast concrete blocks of sufficient strength, size and spacing to support the bars in proper locations.

C. Provide stainless steel components for placement within 1-1/2 inches of surfaces exposed to weather, unless otherwise noted.

D. Post-installed anchors in existing concrete: Install post-installed anchors in existing concrete as specified on the drawings and per manufacturer's specifications.

2.3 FABRICATION

A. All reinforcing bars shall be shop fabricated to conform to the required shapes and dimensions, in accordance with CRSI standards.

B. All reinforcement shall be bent cold.

C. Reinforcement partially embedded in concrete shall not be field bent, except as shown on the Contract Drawings or permitted by the City Representative.

D. Inside diameter of bend, other than for stirrups and ties in sizes No. 3 through No. 5, shall not be less than the following:

Bar Size	Minimum Diameter
No. 3 through No. 8	6 *bar diameter*
No. 9 , No. 10, and No. 11	8 *bar diameter*
No. 15 and No. 18	10 *bar diameter*

E. Inside diameter of bend for stirrups and ties shall not be less than 4 *bar diameter* for No. 5 and smaller.

F. Standard hooks shall mean one of the following:

1. 180-degree bend plus 4 *bar diameter* extension, but not less than 2 ½ inches at free end of reinforcing bar.

2. 90-degree bend plus 12 *bar diameter* extension at free end of reinforcing bar.

3. Stirrups and Tie Hooks:

a. No. 5 bar and smaller, 90-degree bend plus 6 *bar diameter* extension at free end of reinforcing bar

b. No. 6, No. 7, and No. 8 bar, 90-degree bend plus 12 *bar diameter* extension at free end of reinforcing bar

c. No. 8 bar and smaller, 135-degree bend plus 6 *bar diameter* extension at free end of bar

G. Reinforcing bars that are to be butt spliced, placed through limited diameter holes in metal or have a threaded end shall have the applicable end saw-cut.

H. Reinforcing bars shall not be damaged in bending or straightening, and reinforcing bars with kinks or improper bends shall not be used on the job.

I. Welding of reinforcing bars shall conform to AWS D1.4. Type and location of welded splices and other required welding of reinforcing bars shall be as indicated on the Contract Drawings.

J. Headed reinforcing bar shall be HRC 555 headed reinforcing bars as manufactured by Headed Reinforcement Corp., Fountain Valley, CA, or nVent LENTON Terminator as

manufactured by nVent, Solon, OH, or approved equal.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that surfaces, over or against which concrete is to be placed, are clean and in proper condition for placing reinforcement.

B. Verity that items to be embedded in concrete, such as anchor bolts, inserts, sleeves, and block-outs are secured in place as required.

3.2 PLACEMENT

A. Before placing concrete, reinforcement shall be cleaned of oil, grease, soil, loose mill scale, loose rust, and any other coating of a character that would destroy or reduce the bond.

B. Reinforcing bars shall be secured firmly in position. Use No. 16-gauge black annealed wire at each steel intersection. Use precast mortar blocks, metal chairs, spacers, metal hangers, supporting wires, and other approved devices to set steel in position with sufficient strength to resist crushing under full load and to prevent displacement during concrete placing operations.

C. Welding of crossing bars shall not be used for assembly of reinforcement unless permitted by the licensed design professional in responsible charge of the work.

D. Precast Concrete Blocks: Precast concrete blocks shall not be less than 3 inches square with embedded wires and shall have at least the same 28-day compressive strength as the surrounding concrete. Space concrete blocks no less than 1’-6” and no more than 3 feet apart.

E. Minimum concrete cover for reinforcement and minimum clear bar spacing shall be as specified on Contract Drawings, but in no case shall be less than values specified in ACI 318.

F. Placing bars on layers of fresh concrete as the work progresses, or adjusting bars during the concrete placement, will not be permitted.

G. Field bending of reinforcement partially embedded in concrete shall not be permitted, except as shown in the construction documents or permitted by the licensed design professional in responsible charge of the work.

H. Do not displace or damage vapor barrier.

3.3 SPLICING

A. Lap Splices:

1. Reinforcing bars shall be lap spliced as indicated on the Contract Drawings. Splices at locations other than those indicated are subject to the approval of the City Representative and, if permitted, shall conform to the lap lengths specified in the Drawings, but not less than 40 bar diameters.

2. Locate splices not indicated on the Contract Drawings at points of minimum stress. Indicate splice locations on shop drawings. Splice locations shall be well

staggered with no more than 50% of the bars spliced at any section, subject to review by the City Representative. Welded splices or mechanical couplers may be substituted for contact lap splices at the discretion of the Contractor, subject to approval by the City Representative.

3. Offset bars shall be bent before placement in the forms.

B. Welded Splices:

1. No reinforcing bars shall be welded either during fabrication or placement unless specifically shown on the Contract Drawings, specified herein, or with prior written consent of the City Representative. All reinforcing bars that have been welded without such approval shall be rejected and immediately removed from the work site. When welding of reinforcement is approved or shown, it shall conform to AWS D1.4. All welded splices shall be subjected to Special Inspection performed by a certified Special Inspection and Testing Agency.

C. Mechanical Coupler Splices:

1. Perform installation of coupler and tightening of joint assembly in accordance with the coupler manufacturer's installation instructions and recommendations.

2. Ensure proper clearance at splice locations as to not inhibit placement of concrete.

3.4 REINFORCEMENT AROUND OPENING

A. Whenever conduit, piping, sleeves, bolts, hangers, boxes or other embedded items interfere with the proper placement of reinforcing steel as detailed, the Contractor shall submit to the City Representative the proposed reinforcement adjustment for review. Reinforcing bars shall not be bent around openings or sleeves, except with the City Representative's prior approval.

3.5 QUALITY CONTROL

A. Contractor shall provide quality control of reinforcement placement to ensure conformance with Contract Drawings. Contractor to verify size, location, and materials are placed within acceptable tolerances of ACI 117 and ACI 318.

3.6 QUALITY ASSURANCE

A. Special Inspection:

1. Before concrete is placed, reinforcement placement and anchor bolt placement shall be inspected by an approved Special Inspection and Testing Agency.

2. Any errors, discrepancies, or deficiencies shall be corrected before concrete placement. Re-inspection shall be paid for by the Contractor.

3. The Special Inspection and Testing Agency shall be notified for reinforcing steel special inspection not less than 48 hours prior to concrete placement.

B. Structural Observation:

1. Where required by the Contract Documents, structural observation of the reinforcement placement shall be provided by the registered design professional in responsible charge of the work prior to concrete placement.

2. Any errors, discrepancies, or deficiencies shall be corrected before concrete

placement.

3. Registered design professional shall be notified for structural observation not less than 72 hours prior to concrete placement.

END OF SECTION