SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout for baseplates and bearing plates.

B. Related Sections:

1. Division 03 Section “Cast-in-Place Concrete” for setting anchor rods and embedded plates in concrete.
2. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
3. Division 05 Section "Metal Stairs."
4. Division 09 painting Sections for surface-preparation, priming requirements and touch up painting.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers’ written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 PERFORMANCE REQUIREMENTS

A. The drawings indicate typical connection details, specific connection details and/or connection details indicating design intent for the various connection locations required by the drawings. Simple connections may not be detailed on the drawings. The steel fabricator shall provide details of all connections including the connections not specifically detailed, following the intent of the drawings. The connection design shall be performed under the supervision of a qualified professional engineer registered in the state where the project is located. The connections shall be designed for loads shown on the drawings. Where the reactions of beams and girders are not shown, the connections shall be designed to support the maximum allowable uniform loads as indicated in the load tables of the AISC Steel Construction Manual for the given beam size and span. Double angle and single plate connections detailed in accordance with the AISC Steel Construction Manual are acceptable; single angle connections are not permitted.

1. Select and complete connections using schematic details indicated and AISC 360.

1.7 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. See Section 013310 for Submittal Schedule.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating F1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M or as noted on drawings.

D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325 or F 1852, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

B. Bolts, nuts and washers indicated to be galvanized on drawings shall be hot dipped galvanized per ASTM A153.

C. Unheaded Anchor Rods: provide ASTM F 1554, Grade 36 unless noted otherwise on drawings.

1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.

3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436 Type 1, hardened carbon steel.
5. Finish: Plain, except if noted on drawings to be galvanized, provide anchor rods, plates, nuts and washers hot dipped galvanized per ASTM A153, class C.

D. Threaded Rods: ASTM A 36.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Plain, except if noted on drawings to be galvanized, provide threaded rods, nuts and washers hot dipped galvanized per ASTM A153, class C.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat. Color as indicted

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

G. Equipment Supports and Mechanical Opening Framing: Framing shown on structural drawings is for general arrangement only and may require modification to suit the actual purchased equipment. Coordinate with mechanical trades for necessary certified drawings before starting fabrication. Steel Fabricator shall provide a complete job ready for installation of equipment, and Contract price shall cover this requirement regardless of subsequent modifications to framing shown on drawings, at no extra cost to the Owner.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, pre-tensioned or slip critical as indicated on the drawings. Twist-off type tension-control bolts are permitted only at joints indicated as pre-tensioned or slip critical.

B. Weld Connections: Comply with AWS D1.1/D1.1M (Structural welding code) and AWS D1.8/D1.8M (Structural welding code, Seismic Supplement) for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. All interior steel exposed to view SSPC – SP6 commercial blast cleaned.
2. All exterior steel exposed to weather SSPC – SP10/NACE No. 2 near white blast cleaned.
3. All other steel SSPC – SP3 power tool cleaned.
4. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for architecturally exposed steel, unless otherwise indicated in Division 05 Section “Architecturally Exposed Structural Steel Framing.”

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated on drawings according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a special inspector to perform shop tests and inspections and prepare test reports.

1. Provide special inspector and testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections shall be inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."

D. Welded Connections: all shop welded connections shall be visually inspected according to AWS D1.1/D1.1M.

E. In addition to visual inspection, complete penetration shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M by ultrasonic inspection procedures per ASTM E164.

F. Required special inspection and verification as outlined in the applicable building code, including but not limited to:

1. Material verification of high strength bolts, nuts and washers.
2. Inspection of high strength bolting.
3. Material verification of steel.
4. Review of welders’ certification.
5. Material verification of weld filler material.

6. Inspection of welding.
7. Inspection of joint details.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base, Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Snug tight joints (bearing bolts) shall be tightened such that all plies are brought into firm contact only. This is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench. Do not over-tighten bearing bolts. Do not use twist-off type tension-control bolts for bearing bolts.
2. Pretensioned and Slip-critical bolts shall be tightened in accordance with AISC by the turn of the nut method, by using direct tension indicators, by properly calibrated wrenches or by using twist-off type tension-control bolts.

B. Weld Connections: Comply with AWS D1.1/D1.1M (Structural welding code) and AWS D1.8/D1.8M (Structural welding code, Seismic Supplement) for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a special inspector to perform tests and inspections and prepare the necessary reports.

B. Required special inspection and verification as outlined in the applicable building code, including but not limited to:

1. Material verification of high strength bolts, nuts and washers.
2. Inspection of high strength bolting.
3. Material verification of steel.
4. Review of welders' certification.
5. Material verification of weld filler material.
6. Inspection of welding.

7. Inspection of joint details.

C. Bolted Connections: Bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts." Non-slip-critical connections require only visual inspection. Pre-tensioned and slip-critical connections require inspection to conform with AISC specifications for the method of tightening selected. Contractor shall discuss with the Engineer prior to erection.

D. Welded Connections: All field welds shall be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, full penetration field welds shall be tested and inspected according to AWS D1.1/D1.1M by ultrasonic inspection procedures, per ASTM E164.

E. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200