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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.

1. Structural steel is that work defined in American Institute of Steel Construction (AISC) “Code of Standard Practice” and as otherwise shown on drawings.
2. Furnish loose lintels and loose beam bearing plates.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section “Structural Special Inspection.”
2. Division 3 Section “Cast-in-Place Concrete.”
3. Division 9 Section “Painting.”

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Detail structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

1.4 SUBMITTALS

A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

B. Product Data for each type of product specified. Include manufacturer’s specifications, installation instructions, laboratory test reports, and other data to show compliance with the specifications (including specified standards).

C. Shop Drawings detailing fabrication and erection of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data in accordance with AISC Specifications and the AISC “Detailing for Steel Construction”, latest edition.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
4. Include erection plans and details.
5. Include ASTM material specifications and grade of steel.

6. Provide setting drawings, templates, and directions for installation of anchor rods and other anchorages.
7. Provide erection details of all field connections.
8. Indicate surface preparation for primer and primer to be used.
9. Shop drawings which show the Architect's or Engineer's title block, logo and/or seal will be rejected and returned unchecked.
10. Computer generated electronic structural construction document files (ACAD) will be made available to the Contractor. The Contractor will be required to sign the Engineer's standard release of liability form and pay a handling fee of $50.00 per drawing prior to receiving the drawing files. Rules for use of said files shall be as defined in the AISC "Code of Standard Practice for Steel Buildings and Bridges," Section 4.3.
11. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.
2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Twist-off tension control assembly.
4. Weld filler materials.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

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

1. AISC's "Specification for Structural Steel Buildings."
2. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
3. AISC's "Seismic Provisions for Structural Steel Buildings."
4. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
5. American Welding Society's (AWS) D1.1-2004 "Structural Welding Code – Steel."
6. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
7. AGA – American Galvanizers Association publication "Recommended Details for Galvanized Structures".
8. AISC – Steel Construction Manual, 13th Edition.

9. SSPC – Steel Structures Painting Manual, Vol. 2 Systems and Specifications; Steel Structures Painting Council; 1995, Seventh Edition.
10. SSPC-VIS 1-89 – Visual Standard for Abrasive Blast Cleaned Steel; Steel Structures Painting Council; 1989.
11. SSPC-VIS 3 – Visual Standard for Power and Hand Tool Cleaned Steel; Steel Structures Painting Council; 1993.

D. Welding Standards: Comply with applicable provisions of AWS D1.1 “Structural Welding Code – Steel.”

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: For clarity in distinguishing between medium carbon steel (A325) bolts and alloy steel (A490) bolts, the structural drawings and this specification classify bolts using generic A325 and A490 designations. Contractor shall provide tension indicating device assemblies, as opposed to plain bolts, as required in the bolt specification below.

B. All structural steel shapes shall be new, unused and perfect stock, free from millscale, rust, flake, pitting, and imperfections, without bends, kinks, and distortions. Shop splicing of members will only be permitted if the member exceeds maximum mill length.

C. Wide Flange and Tee Shapes (Designated as W and WT): ASTM A992.
Wide Flange and Tee Shapes (Designated as M, S, HP, MT and ST): ASTM A36.

D. Channels, Angles, Plates and Bars: ASTM A36.

E. Cold-Formed Structural Steel Tubing: ASTM A500, Grade B.

F. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Non-High Strength Rods (Hooked, Straight, Headed or Threaded): ASTM F1554 Grade 36 and heavy hex carbon-steel nuts.
2. Washers: ASTM A36.

G. Medium Carbon Steel High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers, uncoated. Use plain bolts, washers, and nuts only where required for installation access, where bolts are called to be galvanized, and at contractor's option for snug-tight installation applications.

1. Finish: Plain, uncoated.
2. Twist-Off-Type Tension-Control Assembly: ASTM F1852. Use of twist-off-type tension-control assembly is mandatory except where bolts are allowed by structural drawings to be installed snug-tight, where installation access prohibits use, and where bolts are called to be galvanized. Use of galvanized twist-off type assemblies is not permitted.

H. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: SSPC-Paint 25; zinc oxide, alkyd, linseed oil primer for use over hand cleaned steel.

2.3 GALVANIZING MATERIALS

A. Galvanizing: The zinc used for the coating shall conform to the specifications for slab zinc (Spelter) ASTM designation: B6.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds and repair painting of galvanized steel, with dry film containing not less than 93 percent zinc dust by weight and complying with DOD-P-21035 A or SSPC-Paint 20, Type II.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time. Grout to have a minimum compressive strength at 28 days of 5,000 psi when applied in a fluid consistency.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

a. NS Grout, The Euclid Company.
b. Five Star Grout, U.S. Grout Corp.
c. Masterflow 713, Master Builders.
d. Sikagrout 212, SIKA.

2.5 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A6 and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

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

1. Plane thermally cut edges to be welded.

C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

D. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.
3. Perimeter columns shall have holes through the column web or other devices attached to the columns at 42-45 inches above the finished floor and at the midpoint between the finished floor and the top cable to permit installation of perimeter safety cables.

E. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.6 SHOP CONNECTIONS

A. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1. Bolts: ASTM A325 (ASTM A325M) high-strength bolts, unless otherwise indicated.
2. Connection Type: Unless snug tight connections are noted on the drawings as being permitted, all bolts shall be tightened to full pretensioning load.

B. Do not reuse bolts that have been tensioned.

C. All bolts of same ASTM type shall be of same diameter. In addition, bolts of different ASTM type shall be of different diameter unless otherwise approved by Structural Engineer.

D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work. Remove all cracks, pores, slag inclusions, incomplete fusions, and incomplete penetrations over ½" long in any weld and reweld.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Furnish all steel members in one piece without splicing, unless otherwise noted on project drawings or approved by Structural Engineer.

E. Connections incorporating any of the following shall be marked with an identifying mark painted on the member.

1. Connections using bolts larger than ¾ inches.
2. Bearing connections with bolt threads excluded from shear plane.

2.7 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar other than column bases. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Galvanized surfaces.

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

1. SSPC-SP 2 "Hand Tool Cleaning," all steel except as otherwise specified.
2. SSPC-SP 3 "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. All welded assemblies to be galvanized shall be prepared according to Recommended Practice for Providing High Quality Zinc Coatings (Hot-Dip) on Assembled Products (ASTM A385).

B. Steel shall be thoroughly cleaned by solvent cleaning in accordance with latest edition of Steel Structures Painting Council "Surface Preparation Specification No. 1 (SSPC-SP1).

C. Steel shall be hot-dip galvanized in accordance with ASTM A123.

D. Hardware and threaded fasteners shall be galvanized in accordance with ASTM A153.

E. Safeguard products against steel embrittlement according to ASTM A143.

F. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

G. Coating weight shall conform with paragraph 5.1 of ASTM A123 or Table 1 of ASTM A153, as appropriate.

H. Surface finish shall be continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.

I. Adhesion shall withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until 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 specifications referenced in this Section.

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

1. Column base plate anchor rods shall not be repaired, replaced, or field modified without the approval of the Structural Engineer. Prior to erection of a column the Contractor shall provide written notification to the Erector if there has been any repair, replacement or modification to its anchor rods.
2. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
3. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

4. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

    a. Comply with manufacturer's instructions for proprietary grout materials.

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

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

1. Level and plumb individual members of structure.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds, and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection unless specifically approved by the Engineer.

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

I. Provide all bracing, temporary bracing and accessories required for complete erection. Safety and adequacy of bracing and temporary bracing are the Installer's responsibility.

J. After erection, remove weld flux, rust, dirt or other foreign material from areas to receive touch-up paint. Repaint areas where protective coating has been damaged or is missing with shop primer paint.

3.4 FIELD CONNECTIONS

A. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1. Bolts: ASTM A325 (ASTM A325M) high-strength bolts, unless otherwise indicated.
2. Connection Type: Unless snug tight connections are noted on the Drawings as being permitted, all bolts shall be tightened to full pretensioning load.

B. Do not reuse bolts that have been tensioned.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work. Remove all cracks, pores, slag inclusions, incomplete fusions, and incomplete penetrations over ½" long in any weld and reweld.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

3.5 QUALITY CONTROL

A. General: The Owner will engage an independent testing and inspecting agency to perform inspections and tests and to prepare test reports. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements. Failure to detect any defective materials shall not prevent later rejection when such defect is discovered, or obligate the Architect or Owner for final acceptance.

1. See Section 014110 – Structural Special Inspections for testing and inspection to be performed.
2. Provide access for testing agency to places where structural steel work is being installed so that required inspection and testing can be accomplished.
3. The General Contractor shall provide the testing agency a complete set of approved shop drawings.
4. Reports will be delivered to the Architect, Engineer, Steel Fabricator and the General Contractor within one week of inspection.
5. Deviations from requirements of the contract documents will be reported in writing to the General Contractor within 24 hours.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

3.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A780. Minimum thickness requirements for the repair are those described in ASTM A123, Section 4.6.

END OF SECTION 051200