SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1  GENERAL

1.01 GENERAL REQUIREMENTS

A. PART A and DIVISION 1 of PART B are hereby made a part of this SECTION.

B. Examine all conditions as they exist at the project prior to submitting a bid for the work of this SECTION.

1.02 SCOPE OF WORK

A. The work of this Section consists of furnishing and erecting all structural steel work and Architecturally Exposed Structural Steel work (AESS) as shown on the Drawings and as specified herein and includes, but is not limited to, the following:

1. Leveling plates and anchor rods.
2. Columns with base plates and connections.
3. Beams with connections.
4. Moment Connections
5. Channels, angles, plates, frames, anchors, etc.
6. Steel bracing with connections.
7. Shop paint and field touch-up paint after erection.
9. As-Built column and base plate surveys.

All structural steel that is exposed in the finish work shall be Architecturally Exposed Structural Steel work (AESS). Coordinate locations of all AESS with the Architectural Drawings.

B. MA-CHPS Requirements:

Steel shapes and plates shall be manufactured using minimum 90% recycled materials.
Steel tubes shall be manufactured using minimum of 25% recycled materials.

C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE: Anchor rods, embedded plates with bolts or anchors, as indicated on the Drawings.

1.03 RELATED SECTIONS

A. Related work shall be performed under the following Sections:

1. Section 033000 CAST-IN-PLACE CONCRETE.
2. Section 040001 MASONRY.
3. Section 050001 MISCELLANEOUS AND ORNAMENTAL IRON.
4. Section 051226 SHEAR CONNECTORS.
5. Section 053100 STEEL DECKING.
6. Section 055000 MISCELLANEOUS METALS.
7. Section 090007 PAINTING.

1.04 REFERENCES (LATEST EDITIONS)


B. The second sentence in paragraph 4.2.1 of the “Code of Standard Practice for Steel Building and Bridges” is not applicable under the provisions of this specification.

C. The “Seismic Provisions for Structural Steel Buildings” by the American Institute of Steel Construction, Inc.

D. The “Connections Manual of Steel Construction” by the American Institute of Steel Construction, Inc.

E. "Structural Welding Code - Steel" by the American Welding Society.


H. ASTM listed standards by the American Society for Testing and Materials.

I. SSPC listed standards by the Steel Structures Painting Council.

J. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.

K. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.05 SUBMITTALS

A. Submit complete Shop Drawings in accordance with the provisions of SECTION 013300 - SUBMITTALS.

B. Before starting the work of the Shop and Erection Drawings, the steel fabricator shall have their representatives contact the Architect and arrange to meet with the Architect and Structural Engineer to discuss connection details, schedules, shop procedures, materials, and other concerns related to structural steel work.

C. Prior to preparation of Shop Drawings, the fabricator shall submit typical details of all structural steel and Architecturally Exposed Structural Steel connection types including, but not limited to, beam to column and beam to girder connections, bracing details, etc.,
for approval by the Architect and Structural Engineer. Design of all connections is to be provided by the fabricator, under the supervision of a registered engineer.

D. Prior to submission of Shop Drawings, Contractor shall verify all dimensions, site conditions, etc., relating to existing conditions. Any discrepancies which affect the structural design or details shall be brought to the attention of the Architect and Structural Engineer.

E. No variance from design sizes and details will be permitted on submitted Shop Drawings; but fabricator requests for modifications of connection type or details, to better suit their shop practice or for any other reason, will be considered by the Architect and Structural Engineer.

F. Shop Drawings shall include all information required for fabrication of the component parts of the structure. Erection drawings shall clearly indicate all AESS members. They shall indicate size and weight of members, surface preparation, type size and location of shop and field connections, the type, size and extent of all welds. Identify grinding, finish and profile of welds. The welding symbols used on the Shop Drawings shall be as adopted by the American Welding Society. Identify type, size, finish and length of bolts, distinguishing between shop and field bolts. Indicate direction of bolt head orientation at connections for all AESS members.

G. Approval of Shop Drawings shall be for size and arrangement of principal and auxiliary members and for strength of connections. Any errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.

H. Fabrication of any material or performing of any work prior to the final approval of the Shop Drawings will be entirely at the risk of the Contractor.

I. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the following conditions:

1. The entity producing the Shop and Coordination Drawings (The “User”) agrees to accept the reproduced information from Foley Buhl Roberts & Associates Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.

2. The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.

3. The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or relate to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

J. Provide manufacturer’s data for structural steel primers to be used.

K. Submit certified copies of mill test reports for all structural steel furnished.
L. **MA-CHPS Documentation:** Material costs for structural steel, recycled material content for structural steel and other items as required by Specification Section 018113 SUSTAINABLE DESIGN REQUIREMENTS.

1.06 **MOCKUPS**

A. At least four (4) weeks prior to fabricating AESS, the fabricator shall construct mockups to demonstrate aesthetic effects as well as the qualities of the materials and workmanship. Mockups of details shall include a representation of each type of exposed connection or built up member.

B. Build mockups on site for review and approval by Architect. Mockups shall be full-size pieces, unless smaller models are approved by the Architect. Mockups may be part of the completed structure, as approved by the Architect.

1. Obtain Architect’s approval of mockups prior to fabrication of final units.

2. Mockups shall have a finished surface, including surface preparation and paint/fire protection system.

C. Retain and maintain mockups during construction in an undisturbed condition, as a standard for judging the completed AESS work.

1.07 **QUALITY ASSURANCE**

A. **Qualifications:** The steel fabricator and erector conducting the work of this Section shall be AISC certified and experienced in fabricating AESS similar to that required for this project.

B. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect, or by the Testing Agency. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall Testing Agency’s acceptance of materials or workmanship prevent later rejection of it by the Owner or Architect if defects are discovered.

C. A qualified Testing Agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.

D. Inspection of welding work other than moment connections shall consist of non-destructive spot testing done by visual, magnetic particle, radiographic or ultrasonic methods, whichever is most effective for joint to be tested.

E. Inspection of welding for work for moment connections shall be tested one hundred (100) percent either by ultrasonic or by radiography in accordance with the latest edition of the AWS Structural Welding Code.

F. Inspection of bolting work shall be in accordance with “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts” by the American Institute of Steel Construction, latest edition. All bolting shall be visually inspected as directed by the Architect and Structural Engineer.

G. The Contractor shall give proper notice to Testing Agency and shall allow access and full facilities as required for this inspection.
H. A final report shall be issued by the Testing Agency following the completion of work in this Section.

1.08 SUBSTITUTIONS

A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the following conditions:

1. That request has been made and accepted prior to submission of Shop Drawings.

2. That there is a substantial cost advantage or time advantage to the Owner.

3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural Steel W-shapes: Shall comply with ASTM A 992 or A588-Grade B (50 ksi minimum yield).

B. Structural Steel Bars, Plates, Channels, and Angles: Shall comply with ASTM A 36 (36 ksi minimum yield).

C. Structural Steel Square or Round Tubing: Shall comply with ASTM A 500, Grade B (46 ksi minimum yield for rectangular shapes, 42 ksi minimum yield for round shapes).

D. Bolts, nuts and washers shall comply with the requirements of ASTM A 325. Bolts shall be A 325N with washer, except A 325, Type SC at slip critical connections indicated on the Drawings.

E. Anchor rods shall comply with the requirements of ASTM F 1554 – Grade 36, except F 1554 – Grade 105 as indicated on the Drawings. All anchor rods shall be headed type, with washer.

F. Expansion bolts shall be Hilti Kwik Bolt TZ Expansion Anchors; Strong Bolt by Simpson Strong Tie; or Wedge Bolt by Powers Fastening Systems or an equal approved by the Architect.

G. Epoxy injection anchor bolts shall be Hilti HIT Adhesive Anchors, ET with Set XP Epoxy Adhesive Anchors by Simpson Strong Tie, PE 1000 Epoxy Adhesive Anchor System by Powers Fastening Systems or an equal approved by the Architect. Use renovation screens when bolting to hollow substrate.

H. Metallic Filler: Composition of 90% ground metal and 10% epoxy binder.
2.02 FABRICATION

A. All structural steel shall be fabricated in accordance with References, approved Shop Drawings, and as hereinafter specified.

B. All structural steel to remain exposed to view shall be fabricated in accordance with Chapter 10, Architecturally Exposed Structural Steel (AESS), in the AISC manual, unless more stringent requirements are specified herein. Continuously weld joints in AESS members. The welds shall be ground or otherwise treated as required to blend with adjacent parent metal. In addition, fabricate as follows:

1. Fabricate AESS with exposed surfaces smooth, square and of surface quality with the approved mockups. Use special care in handling and shipping AESS before and after shop painting.
2. Fabricator shall grind welds of AESS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within +1/16” and –0” of plate thickness.
3. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one piece construction when primed. Grind and polish as required, to match profile on approved mockup.
4. Where continuous welding is noted on the Drawings, provide uniform size and profile. All exposed welds shall be continuous, unless otherwise noted on the Drawings.
5. Fabricate AESS members such that piece marks are fully hidden in the final structure or use media to permit full removal.
6. Members specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem and of outstanding flanges of open sections shall be visibly acceptable to the Architect from a distance of 20 feet under any lighting condition.
7. Seal weld open ends of rectangular hollow structural sections with 3/8” minimum closure plates.

C. The design of members and connections for any portions of the structure not indicated on the Drawings shall be completed by the fabricator. Unless otherwise noted on the drawings, connections shall be capable of supporting the maximum uniform load of the member for the span shown and the material specified. Consideration must be given to the additional load carrying capacity of composite steel members. In general, and unless otherwise indicated, connections for composite beams shall be designed for at least 1.75 times the end reaction derived from the AISC uniform load beam tables for the particular beam and span. Connections for girders which support other beams should be designed for at least 1.5 times the AISC uniform load reaction. All connection design shall be subject to approval by the Architect and Structural Engineer.

D. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.

E. All shop connections shall be welded or bolted.
F. Weld and joint details shall comply with requirements of the "Structural Welding Code - Steel" by the American Welding Society.

G. Bolting shall comply with the requirements of AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

H. All field connections shall be bolted, except where welding is indicated on the Drawings. All field bolts shall be alternate design type tension control with twist off elements.

I. Diameter of holes in bolted parts shall be 1/16" greater than the nominal diameter of the bolt. No unfair holes will be accepted, and enlargement of holes shall not be accomplished by burning. Burrs resulting from drilling or punching shall be ground to the surface of the material. Shearing and punching shall be done cleanly so as not to deform or mar adjacent surfaces.

J. Provide holes and connections as required for site assembly of steel work. Holes shall be drilled or punched and reamed in the shop. Show sizes and locations of all such holes on the Shop Drawings.

K. Provide angles, bars, etc. as necessary for deck support at columns where members do not frame in from all four sides and where connections interfere with the support of metal decking.

L. Provide angles, channels, etc. around all openings in roof deck at drains, fans, etc. as shown in drawings. Coordinate size, number, and location with architectural, mechanical, electrical, and plumbing trades.

M. In general, beam to beam, and beam to column connections shall be double angle type connections, unless otherwise shown on the Drawings.

2.03 SURFACE PREPARATION AND PROTECTIVE COATINGS

A. All structural steel shall be cleaned of all scale, rust, grease and other foreign matter.

B. Surface preparation for interior not exposed to view structural steel shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 3, Power Tool Cleaning."

C. Surface preparation for interior exposed to view structural steel and all exterior structural steel shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 6, Commercial Blast Cleaning".

D. Shop prime all steel members as specified herein, except the following:
   1. Surfaces embedded in concrete.
   2. Surfaces to be field welded.
   3. The tops of steel beams where deck is to be welded.
   4. Surfaces to be fireproofed.

E. Primer for interior structural steel, not exposed to view shall be “TNEMEC” Series 1009 Gray Primer, Rust-Oleum 1060 Gray Primer, Pratt and Lambert S4551 Gray Primer or equivalent as approved by the Architect.
F. Primer for interior structural steel, exposed to view shall be “TNEMEC” Series 37H-77W White Primer, Pratt and Lambert S4751 – White Universal Alkyd HP Primer or equivalent as approved by the Architect.

G. Primer for exterior structural steel, exposed to view shall be “TNEMEC” 90-1K97 TNEME-ZINC reddish –gray primer (3.0-3.5 mils d.f.t.).

H. Primer shall be applied in accordance with manufacturer’s instruction to provide a minimum dry film thickness of 1.5 mils at non-exposed areas and 3.0 to 3.5 mils at exposed areas. Use priming methods that result in full coverage of joints, corners, edges and exposed surfaces.

I. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field as required under Section 090007 PAINTING.

J. Primer paint shall be applied in accordance with manufacturer's directions to ensure no running or sagging.

K. After erection, all scarred areas shall be touched up with the same paint as the shop coat.

2.04 GALVANIZING

A. All steel items that are noted on the Drawings to be galvanized shall be galvanized by the hot dip process conforming to ASTM A123 with the addition of nickel to zinc bath. All galvanizing shall be done after fabrication. All galvanized material to be painted shall be given one, SSPC NO.3 surface preparation and phosphate conversion treatment after galvanizing and shall be primed by the galvanizer within twelve hours after galvanizing and shall be force cured in a facility capable of maintaining 150 degrees F. All hot dip galvanized steel shall be safeguarded against embrittlement according to ASTM A143.

B. The galvanizer shall inspect all members for compliance with this specification, and shall mark each member with a stamp indicating the ASTM number and the weight of the zinc coating in ounces per square foot.

PART 3 EXECUTION

3.01 STORAGE AND HANDLING

A. Care and protection shall be given to all structural steel during handling and storage. If items are to be stored prior to installation, they shall not be placed in contact with the ground. Care shall be taken to avoid abrasions and damage.

3.02 ERECTION

A. All structural steel shall be anchored and erected in accordance with References, approved Shop Drawings, and as hereinafter specified.

B. All structural steel to remain exposed to view shall be erected in accordance with Chapter 10 Architecturally Exposed Structural Steel, in the AISC manual, unless more stringent requirements are specified herein.
1. Grind all field welds of AESS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within +1/16” and –0” of plate thickness.

2. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one-piece construction when primed. Grind and polish as required, to match profile on approved mockup.

3. Where continuous welding is noted on the Drawings, provide uniform size and profile. All exposed welds shall be continuous, unless otherwise noted on the Drawings.

4. Bolt heads shall be oriented as shown on the approved Shop Drawings.

5. Run-out tabs, angles, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure. Remove backer bars, fill all “rat” holes and grind smooth at groove welded joints. Fill or plug weld holes for temporary erection bolts and grind smooth. All areas shall be touched up with the appropriate shop primer.

6. Splice members only as approved on the submitted Shop Drawings.

C. All work shall be accurately set to established lines and elevations and rigidly fastened in place with suitable attachments to the construction of the building.

D. Temporary bracing, guying, and support shall be provided to keep the structure safe and aligned at all times during construction, and to prevent danger to persons and property. Check all temporary loads and stay within safe capacity of all building components.

E. Except as otherwise indicated on the Drawings, all field connections shall be bolted in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts". All bolts shall be fully tensioned. Use not less than one (1) washer placed under the turning part of the assembly. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

F. The initial installations of expansion bolts and epoxy injection anchor bolts, shall be witnessed by the manufacturer’s representative and load tests shall be performed to test their adequacy.

G. Do not cut or alter any member in the field without Architect's written approval for each specific condition.

H. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS “Standard Qualifications Procedure” for the type of work required.

I. After erection, all structural steel members and connections shall be touched up with the appropriate primer.

J. Prior to field welding of any galvanized steel element, galvanizing in the general area to be welded must be removed by grinding.
K. All galvanized steel elements shall be touched up with a zinc-rich paint at areas scarred by welding or bolting.

3.03 SURVEY

A. Engage the services of a licensed Engineer or Surveyor to survey elevations and locations of all column and arch bases, prior to start of erection of structural steel. Any discrepancies shall be brought to the attention of the Architect. Erection shall not proceed until any required remedial measures have been completed.

B. Upon completion of the building frame provide a survey of perimeter building columns that indicates the plan deviation (as applicable) from the column grid in each direction.

3.04 TOLERANCES

A. Individual structural steel members shall be plumbed, leveled, and aligned in accordance with the requirements of Chapter 7 of the “Code of Standard Practice for Steel Buildings and Bridges”, except as follows:

1. All tolerances (rolling, fabrication, erection, etc.) combined shall result in a framing in the complete structure being located within ¾ inches of its theoretical location, except that members at connections to columns shall be within 1/8 inch vertically of their theoretical elevations.

2. Tolerances for Architecturally Exposed Structural Steel (AESS) shall not exceed one-half those permitted for structural steel.