SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame indicated on Drawings and as described in ANSI/AISC 303.

B. Seismic-Force-Resisting System: Elements of structural-steel frame designated as "SFRS" or along grid lines designated as "SFRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A6/A6M with flanges thicker than 50 mm.
2. Shapes in SFRS with flanges thicker than 38 mm.
3. Welded built-up members with plates thicker than 50 mm.
4. Column base plates thicker than 50 mm.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Force-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.2 QUALITY ASSURANCE

A. Products and Equipment shall demonstrate compliance with requirements specified in Section 016000.

B. Quality System: Comply with ISO 9001/9002 Quality System as a minimum.

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

1. AISC "Manual of Steel Construction; American Institute of Steel Construction" 15th Edition.
2. AISC 303-16 "Code of Standard Practice for Steel Buildings and Bridges".
3. AISC 360-16 "Specification for Structural Steel Buildings".
4. AISC "Seismic Design Manual; American Institute of Steel Construction" Third Edition.
5. AISC 341-16 "Seismic Provisions for Structural Steel Buildings"
6. AISC 358-16 / AISC 358s1-18 / ANSI/AISC 358s2-20 "Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications, including Supplement No. 1 and No. 2"
7. AISI "Cold-Formed Steel Design Manual; American Iron and Steel Institute" Edition 2017.
8. ASTM A6/A6M "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
9. AWS "American Welding Society AWS D1.1/D1.1M:2015 Structural Welding Code – Steel and AWS D1.6/D1.6M:2017 Structural Welding Code – Stainless Steel".
10. Steel Structure Painting Manual Steel Structures Painting Council; Latest edition.
11. RCSC 2020 "Specifications for Structural Joints Using High-Strength Bolts".

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

1.3 COORDINATION

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

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Structural Steel Shapes, Plates, and Bars: As follows:

1. Carbon Steel: ASTM A36/A36M having a minimum yield stress of 250 N/mm^2 or approved equal, to be used only when specified.
2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A572/A572M, Grade 50 having a minimum yield stress of 345 N/mm^2 or approved equal, typically used.
3. High-Strength, Low-Alloy Structural Steel: ASTM A588/A588M, Grade 50, corrosion-resistant, to be used only when specified.
4. ASTM A992/A992M, Grade 50 having a minimum yield stress of 345 N/mm^2 or approved equal for W-sections.

B. Structural Steel for square and rectangular cross-sections is to conform to:

1. ASTM A501/A501M Grade A having a minimum yield stress of 250 N/mm^2 or approved equal, to be used only when specified.
2. ASTM A501/A501M Grade “B” having a minimum yield stress of 345 N/mm^2 or approved equal, typically used.

C. Structural Steel for hollow circular sections is to be:

1. ASTM A53/A53M type E, Grade B, having a minimum yield stress of 240 N/mm^2 or approved equal, to be used only when specified.
2. ASTM A618, Grade III, having a minimum yield stress of 345 N/mm^2 or approved equal, typically used.

D. Cold rolled steel Z and C sections to be ASTM A653M grade HSLAS, type A, Grade 50 and ASTM A924/A924M, having a minimum yield stress of 345 N/mm^2, or approved equal, and shall be galvanized in accordance with the ASTM A653/A653M with zinc coated to achieve the specified life to first maintenance.

E. Welding Materials: Conform to AWS Code and AWS Filler Metal Specifications. Select materials which are suitable for use with types of steel to be joined. Unless otherwise indicated, connections are designed for:

1. Metal-Arc Welding Electrodes: to E70XX series of the Specification for Mild Steel Covered Arc-Welding Electrodes, AWS A5.1, or the Specification for Low-Alloy Steel Covered Arc-Welding Electrodes, AWS A5.5.
2. Bare Electrodes and Granular Flux used in the submerged-arc process are to conform to F7 X-EXXX AWS flux classifications of the Specification for Base Mild Steel Electrodes and Fluxes for Submerged Arc Welding, AWS A5.17, or A5.23 or the of AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".

2.2 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts: Heavy-hex steel structural bolts to ASTM F3125/F3125M, Grade A325M, Type 1 (galvanized where required); with matching heavy-hex carbon-steel nuts and washers. Or EN ISO 898 (BSEN 14399 where required) property class 8.8 (galvanized where required) with the matching nuts and washers.

B. High-Strength A490 Bolts: Heavy-hex steel structural bolts to ASTM F3125/F3125M, Grade A490M, Type 1 (Type 3 where required); with matching heavy-hex carbon-steel nuts and washers. Or EN ISO 898-1 (BSEN 14399 where required) property class 10.9 (galvanized where required) with the matching nuts and washers.

C. Headed Stud-Type Shear Connectors: Headed-stud type, cold finished carbon steel, to AWS D1.1/D1.1M, Type B, minimum yield strength 345 N/mm^2 [50000 PSI] at 0.2% offset, made from steel to ASTM A108, with mechanical properties to ASTM A370, and applied in accordance with Recommended Practices for Stud Welding.

2.3 ANCHORS AND RODS

A. Anchor Rods:

1. ASTM F1554, Grade 36 with a minimum yield strength of 248 N/mm^2, galvanized where required.
2. ASTM F1554, Grade 55 with a minimum yield strength of 380 N/mm^2, weldable and galvanized where required.
3. ASTM F1554, Grade 105 with a minimum yield strength of 724 N/mm^2, galvanized where required.

2.4 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout

B. Nonmetallic, Shrinkage-Resistant Grout

2.5 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to ANSI/AISC 303 specifications and other specifications referenced in this Section.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123 where required.

2.7 SHOP PRIMING

A. Shop prime steel surfaces

2.8 SOURCE QUALITY CONTROL & QUALITY ASSURANCE

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL & QUALITY ASSURANCE

A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections and to prepare test reports.

B. Field Welding: Inspect and test during erection of structural steel.

3.2 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780.

END OF SECTION 051200

SECTION 055000 - METAL FABRICATIONS

1.1 PRODUCTS

A. Materials: Steel plates, shapes, and bars, Stainless steel plates, shapes, and bars, Steel tubing, Steel pipe, Slotted channel framing and Aluminum.

B. Miscellaneous Framing and Supports: Galvanized where indicated.

1. Steel framing and supports for overhead doors countertops mechanical and electrical equipment and applications where framing and supports are not specified in other Sections.
2. Elevator machine beams, hoist beams, and divider beams.
3. Steel shapes for supporting elevator door sills.

C. Metal Ladders : Steel.

1. Galvanized ladders.

D. Miscellaneous Steel Trim: steel edgings.

1. Galvanized trim.

E. Metal Bollards: Schedule 40 steel pipe.

1. Primed using zinc-rich primer.

F. Abrasive Metal Nosings Treads and Thresholds: Cast aluminum.

G. Loose bearing and leveling plates, galvanized.

H. Loose steel lintels, galvanized at exterior walls.

I. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts cast into concrete or built into unit masonry.

J. Steel weld plates and angles not specified in other Sections, for casting into concrete.

K. Brushed Bronze Sheets as per ASTM B36/B36M, Alloy UNS No. C28000..

1.2 ASTM STANDARDS/REFERNCES

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Tubing: ASTM A 500, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

G. Slotted Channel Framing Material Galvanized steel, ASTM A 653/A 653M.

H. Cast Iron Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

I. Nonferrous Metals
1. Aluminum Plate and Sheet: ASTM B 209M, Alloy 6061-T6.
2. Aluminium Rolled or Cold Finished Bars, Rods and Wire. ASTM B211 (ASTM B 211M).
3. Structural Pipe and Tube: ASTM B 429/B 429M.
4. Aluminum Extrusions: ASTM B 221M, Alloy 6063-T6.
5. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
6. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

J. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563M; and, where indicated, flat washers.

K. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325M, Type 3; with hex nuts, ASTM A 563M, Class 8S3; and, where indicated, flat washers.

L. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 738M; with hex nuts, ASTM F 836M; and, where indicated, flat washers; Alloy Group A1.

M. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

N. Eyebolts: ASTM A 489.

O. Machine Screws: ASME B18.6.7M.

P. Lag Screws: ASME B18.2.3.8M.

Q. Wood Screws: Flat head, ASME B18.6.1.

R. Plain Washers: Round, ASME B18.22M.

S. Lock Washers: Helical, spring type, ASM E B18.21.2M.

T. Anchors, General: according to ASTM E 488.

U. Cast-in-Place Anchors in Concrete: either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel.

V. Bolts, washers, and shims all hot-dip galvanized as per ASTM F 2329.

W. Post-Installed Anchors: chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941M, Class Fe/Zn 5.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group A4 stainless-steel bolts, ASTM F 738M, and nuts, ASTM F 836M.

X. Slotted-Channel Inserts: to comply with ASTM B 633, Class Fe/Zn 5.

Y. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

Z. Non-shrink, Metallic Grout: complying with ASTM C 1107

AA. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

BB. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

1.1 SUMMARY

A. Steel railings.

B. Aluminum railings.

C. Stainless steel railings.

1.2 PERFORMANCE REQUIREMENTS

A. Engineering design of railings by Contractor.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails: Refer to SBC Code.

a. Structural Loads as specified in Section1607.8 of SBC 201. A design factor of four shall be used for safety.

1.3 ASTM STANDARDS/REFERNCES

A. Product Test Reports as per ASTM E 894 and ASTM E 935.

B. Steel and Iron Tubing as per ASTM A 500 (Cold formed).

C. Steel and Iron Pipe as per ASTM A 53/A 53 M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

D. Steel and Iron Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

F. Post-Installed Anchors according to ASTM E 488.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group A1 stainless-steel bolts, ASTM F 738M, and nuts, ASTM F 836M.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Non-shrink, Nonmetallic Grout: ASTM C 1107.

I. Galvanized Railings:
1. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
2. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

J. Galvanized Surfaces: To comply with ASTM A 780.

1.4 FABRICATION

A. Changes in Direction of Members: By bending.

B. Connections: Welded.

C. Toe boards.

1.5 FINISHES

A. Steel and Iron: Galvanized after fabrication, shop painted with high-performance coating.
   1. High Performance Polyurethane Coating System, as specified in Section 099611 “High Performance Coatings”.

B. Aluminum: Class I, clear anodic, unless otherwise indicated by the Engineer.

C. Stainless Steel Tubing: Polished finish, unless otherwise indicated by the Engineer.

END OF SECTION 055213

SECTION 055300 – METAL GRATINGS

1.1 RELATED SECTIONS
1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: In accordance with Structural General Notes.
B. Engineering design of gratings by Contractor.
C. Seismic Performance: Gratings to withstand the effects of earthquake motions determined in accordance with Structural General Notes.

1.3 METAL BAR GRATINGS

A. Welded Steel Grating:

1. Traffic Surface: Applied abrasive.
2. Finish: Hot-dip galvanized.

1.4 GRATING FRAMES AND SUPPORTS

A. Fabricate from same basic metal as gratings.
B. Galvanize steel frames and supports in exterior and interior, where indicated.

1.5 ASTM STANDARDS/REFERNCES

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Rod for Grating Crossbars: ASTM A 510M.

C. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 205.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 230, with Z275 coating.

E. Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls.

F. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM F 568M, Property Class 4.6; with hex nuts, ASTM A 563M; and, where indicated, flat washers.

G. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 738M for bolts and ASTM F 836M for nuts, Alloy Group A1.

H. Plain Washers: Round, ASME B18.22M.

I. Lock Washers: Helical, spring type, ASME B18.21.2M.

J. Anchors: cast-in-place, chemical or torque-controlled expansion anchors, as determined by testing per ASTM E 488.
1. Material for Anchors in Interior Locations: to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: complying with ASTM F 738M and nuts complying with ASTM F 836M.

K. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

L. Ductile Cast Iron Grating: Medium and heavy-duty gratings non-rock type, manufactured from ductile cast iron to ASTM A 536, grade 65-45-12 for medium duty and grade 80-55-06 for heavy duty.

M. Galvanizing: To complying with ASTM A 123/A 123M.

N. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055300