This master should be used by designers working on Port of Portland construction projects and by designers working for PDX tenants (“Tenants”). Usage notes highlight a few specific editing choices, however the entire section should be evaluated and edited to fit specific project needs.

SECTION 055000 – METAL FABRICATIONS

1. GENERAL
	* + 1. DESCRIPTION
				1. This section describes items made from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems specified elsewhere.
			2. REFERENCES
				1. AISC: American Institute of Steel Construction

AISC Specifications for Structural Steel Buildings

* + - * 1. AISI: American Iron and Steel Institute

AISI Specification for the Design of Cold-Formed Steel Structural Members

* + - * 1. ANSI: American National Standards Institute

ANSI A14.3: American National Standards for Ladders - Fixed - Safety Requirements

ANSI A202.1: Metal Bar Grating Manual

Standard Specification for Open Web Steel Joists

* + - * 1. ASTM: American Society for Testing and Materials

ASTM A36: Standard Specification for Carbon Structural Steel

ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A1011: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM F2329: Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

* + - * 1. AWS: American Welding Society

AWS D1.1: Structural Welding Code – Steel

* + - * 1. NAAMM: National Association of Architectural Metal Manufacturers
				2. OR OSHA: Oregon Occupational Safety and Health Administration
			1. SUBMITTALS
				1. Submit the following.

Product Data: Manufacturer’s specifications, anchor details, and installation instructions for products to be used in the fabrication of metalwork, including paint products and grout.

Shop drawings: Show fabrication and erection of metal fabrications. Include drawings, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation under other sections.

Sample corners of handrails and railings as requested.

* + - * 1. Where design of members and connections is specified as part of the work of this section, submit structural analysis showing loadings and stresses, stamped and signed by a structural engineer registered in Oregon with shop drawings showing these items, similarly stamped and signed.
				2. For site welding work, submit a detailed plan of safety procedures that includes fume control and shielding.
			1. QUALITY ASSURANCE
				1. Codes and Standards: Comply with the provisions of the following codes, standards and specifications, except where more stringent requirements are shown or specified:

AISC, “Specifications for Structural Steel Buildings,” including the “Commentary on the AISC Specifications.”

AISI, “Specification for the Design of Cold-Formed Steel Structural Members.”

ANSI, “Standard Specification for Open Web Steel Joists,” including the “Code of Standard Practice for Steel Joists and Joist Girders.”

AWS D1.1, “Structural Welding Code – Steel.”

* + - * 1. Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay work.
				2. Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of metalwork. Coordinate delivery with other work to avoid delay.
				3. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
1. PRODUCTS
	* + 1. MATERIALS AND COMPONENTS
				1. For fabrication of metalwork which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness.
				2. Fabricate metal fabrications from ASTM A36, or as recommended by fabricator for the specific application; except where material is specifically identified.
				3. Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners of the type, grade, and class required.
				4. Metal Primer Paint:

Zinc-coated steel: Acceptable Manufacturers and Products: Amchem Galv-A-Prep, Tnemec Galv-Gard #22; Rustoleum System, or equal.

Black Steel: Acceptable Manufacturers and Products: Amchem Metal-Prep, Tnemec #37 Chem Prime; Rustoleum System, or equal.

Verify compatibility with the required finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified elsewhere.

* + - 1. FABRICATION, GENERAL
				1. Workmanship:

Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

* + - * 1. Weld corners and seams continuously, complying with AWS recommendations. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
				2. Form exposed connection with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, socket type flathead (countersunk) screws or bolts. Provide sufficient backing at screw locations to cover at least three threads.
				3. Provide for anchorage of type suitable for use with supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support for intended use.
				4. Cut, reinforce, drill, and tap metal fabrications as required to receive finish hardware and similar items.
				5. Galvanizing: Provide a zinc coating for those items shown or specified to be galvanized, as follows:

ASTM A123 for galvanizing iron and steel products.

ASTM A153 for galvanizing iron and steel hardware.

ASTM F2329 for galvanizing fasteners.

* + - * 1. Shop Painting:

Shop paint metal fabrications (after galvanizing where a zinc coating is specified), except members or portions of members to be embedded in concrete or masonry, unless otherwise specified.

Remove scale, rust and other deleterious materials before applying shop coat.

Immediately after surface preparation, brush or spray on primer in accordance with manufacturer’s instructions and at a rate to provide uniform dry film thickness of 1.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges and exposed surfaces.

Apply one shop coat to fabricated metal items, except apply two coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

* + - 1. METAL FABRICATIONS
				1. Rough Hardware:

Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other steel and iron shapes as required.

Manufacture or fabricate items of sizes, shapes, and dimensions required.

* + - * 1. Edge and Sill Angles: Provide edge angles fabricated of structural steel shapes as shown, of all welded construction with mitered corners and continuously welded joints. Provide welded anchors for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners and 24 inches o.c., unless otherwise shown. Galvanize exterior edge angles.
				2. Miscellaneous Steel Trim: Provide shapes and sizes as required for profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work. Galvanize exterior miscellaneous steel trim.
				3. Steel Grating:

Use materials of the size and thickness shown, or if not shown, of the size recommended by NAAMM tables for 100 pounds per square foot live load with 1/2 inch maximum deflection. Work to the dimensions shown using proven details of fabrication and support.

Metal Bar Grating: Comply with ANSI/NAAMM A202.1 “Metal Bar Grating” except where more stringent requirements are specified.

Steel Gratings: “Welded” steel bar type, with plain surface. Hot-dip galvanize after fabrication, and shop prime.

Provide removable grating sections with edge banding bars. Secure from building interior by method which will not allow removal from exterior, as applicable.

Weld stud bolts to receive saddle clip anchors to supporting steel members or framework.

Notching of bearing bars at supports to maintain elevations will not be permitted.

Cut, drill and fit as required for installation. Set grating accurately in location, alignment and elevation, plumb, level, true and free of rack.

At mechanical stairs to roof, provide grating treads with checkered plate nosings at least 1 1/4-inch wide. Tread Width: At least 1 inch greater than tread run.

* + - * 1. Structural Steel Door Frames:

Fabricate steel door frames of structural shapes as shown, fully welded, uniform, square and true. Continuously weld exposed joints; grind exposed welds smooth.

Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using stud anchors or 1/8-inch x 2-inch straps of the length required for a minimum 6‑inch embedment, unless otherwise shown. Weld anchors to frame jambs not more than 12 inches from both bottom and head of frame and space anchors not more than 30 inches apart.

Galvanize exterior structural steel door frames and anchors.

Provide jambs and headers at coiling doors as indicated.

* + - * 1. Steel Framed Stairs:

General:

Design members and connections as part of work of this section. Provide entire assembly designed to support a minimum live load of 100 pounds per square foot, unless otherwise shown.

Use welding for joining pieces together, unless otherwise shown. Fabricate units so that bolts and other fastenings do not appear on finish surfaces. Make joints true and tight, and make connections between parts light-proof tight. Provide continuous welds, ground smooth where exposed.

Construct stair units to conform to sizes and arrangements as shown; drawings show tread dimensions. Provide metal framing, hangers, columns, struts, clips, brackets, bearing plates and other components as required for the support of stairs and plat­forms from structure. Erect stair work to line, plumb, square, and true with runs registering level with floor and platform levels.

Provide brackets and bearing surfaces as detailed and as required to anchor and contain the stairs on the supporting structure.

Stair Framing: Fabricate stringers of structural steel channels or plates, or a combination thereof, as shown. Provide closures for exposed ends of stringers.

Metal Pan Units:

Form metal pans of 0.1046 inch thick structural steel sheets (12 gauge), complying with ASTM A1011, Grade B. Shape pans to conform to the configuration shown.

Construct metal pans with concealed steel supporting brackets, of size required, welded to stringers. Secure metal pans to brackets with plug welds.

Secure sub-platform metal pans to platform frames with plug welds.

* + - * 1. Railings and Handrails:

Provide steel pipe railings, consisting of top rail, intermediate rails, and posts, and handrails at walls.

Provide railings and handrails designed to support minimum live loads required by applicable codes and the OR-OSHA requirement of at least 200 pounds applied in any direction at any point.

Join posts and rails by welded joints made by fitting post to top rail and intermediate rail to post, groove welding joints, and grinding smooth. Butt railing splices and reinforce by a tight fitting interior sleeve not less than 6 inches long.

Bend railings at corners, uniformly form in jigs, with cylindrical cross-section of pipe maintained throughout the entire bend.

Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment through their length. Plumb posts in all directions. Secure posts and rail ends as follows:

Anchor posts in concrete. Provide openings not less than 6 inches long, and having an inside diameter not less than 1/2 inches greater than the outside diameter of the inserted pipe post.

After the posts have been inserted, fill the annular space solid with a quick setting hydraulic cement.

Weld posts and rail ends to stringers as indicated, grind welds smooth.

Weld guardrail posts to beam and stringers, grind welds smooth.

Secure handrails to walls by means of 1/2-inch diameter solid bar wall brackets through hole in bottom of rail and plug welded to top of rail. Locate brackets, equally spaced, not more than 60 inches o.c., not over 12 inches from ends.

* + - * 1. Ladders:

Fabricate ladders for the locations identified, with dimensions, spacings, details, and anchorages as required. Comply with the requirements of ANSI A14.3, except as otherwise noted.

Unless otherwise shown, provide 1/2-inch x 2 1/2-inch continuous structural steel flat bar side rails with eased edges, spaced 21 inches apart.

Provide 3/4-inch-diameter solid structural steel bar rungs, uniformly spaced not over 12 inches o.c.

Brand name exemption for DBI-Sala is 10/1/2021.

Any fixed ladder 24 feet or longer shall be equipped with a ladder safety system, manufactured by DBI-Sala, no substitutions. The ladder safety system shall be installed and certified by a qualified person having a recognized degree or professional certificate, and with extensive knowledge, training, and experience in the fall protection and rescue field.

Fit rungs into punched holes in centerline of side rails, plug weld and grind smooth on outer rail faces.

Support each ladder at top and bottom and at intermediate points spaced not more than 5'‑0" o.c. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7-inch clearance from wall to centerline of rungs. Extend rails 42 inches above top rung and return rails to wall or structure unless other secure handholds are provided.

* + - * 1. Loose Bearing Plates: Provide loose bearing plates for steel items bearing on concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

Coordinate pipe bollards below with Section 347113, Pipe Bollards.

* + - * 1. Pipe Bollards:

Fabricate bollards from Schedule 40 steel pipe. At bollards provide concrete fill with rounded cap as indicated.

Galvanize exterior bollards.

* + - * 1. Miscellaneous Framing and Supports:

Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work. Galvanize items at exterior and in exterior walls.

Fabricate miscellaneous units to sizes, shapes, and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware and similar items.

Equip units with integrally welded anchor straps for casting into concrete wherever required. Furnish inserts where units must be installed after concrete is placed. Except as otherwise shown, space anchors 24 inches o.c. and provide minimum anchor units of 1 1/4-inch x 1/4-inch, 8-inch steel straps.

Provide 6-inch-square (minimum) 1/4-inch-thick steel plates:

At each point of support of toilet compartments and screens.

At brackets for handrails where bolted.

Where required.

Provide angles for support of masonry work. Galvanize after fabrication.

Provide structural steel shelf angles of sizes shown. Drill holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c. unless otherwise shown. Where concealed, add 2-inch diameter holes 6 inches o.c. for drainage.

Provide lintels as indicated.

Steel Support Frames: Provide for penetrations of exterior walls.

Interior Sign Supports: Provide for roof, wall, and ceiling-hung signs.

Sump Pit Frames: Provide angles, to support steel grating, of all welded construction with mitered corners and continuously welded joints. Provide headed stud anchors for embedding in concrete, spaced not more than 6 inches from each corner and 24 inches o.c. Galvanize sump pit frames.

Steel Counter Supports: Provide angles to support lavatory counters as shown. Drill holes to receive screws for attachment to metal studs.

Concrete Masonry Header Support: Provide bent plate deflection head at top of CMU veneer as indicated. Include angle struts, clips, and brackets to structure above. Coordinate strut installation with mechanical items above ceiling.

Elevator Rail Backing: Provide supporting tube steel as indicated. Include clips, bracket and anchorage devices for securing metal fabrications to in-place construction.

* + - * 1. Provide other miscellaneous steel items. Work of this section is not limited to the items listed above.
1. EXECUTION
	* + 1. INSPECTION
				1. Examine areas and conditions under which metal fabrications are to be installed. Correct conditions which are detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
			2. PREPARATION
				1. Provide setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the work site.
			3. INSTALLATION
				1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction including threaded fasteners for concrete inserts, toggle bolts, through-bolts, and other connectors as required.
				2. Cutting, Fitting and Placement:

Perform cutting, drilling, and fitting required for installation of metal fabrications. Set work accurately in location, align­ment and elevation, plumb, level, true and free of rack, measured from established lines and levels with lines visually parallel. Provide temporary bracing or anchors in framework for items which are to be built into concrete or masonry of similar construction.

Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop-welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

* + - * 1. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

Fume Control:  Provide welding fume control to protect personnel and the public from exposure to heavy metals.

Shielding:  Provide shielding for arc welding operations to protect personnel and the public that may have visual or other access during the work.

* + - * 1. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 1.0 mils.

END OF SECTION 055000