

DIVISION 05 – METALS

Sustainability: Provide steel containing a minimum of 50% recycled content.

Historic: Follow the Secretary of the Interior's Guidelines for Rehabilitating Historic Buildings.

05-12-00 Structural Steel Framing

Note: The following if for concealed structural steel. Provide further detailed specifications for expected finishes on all exposed structural steel.

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Submit Product Data for each type of product indicated.
- C. Submit Shop Drawings: Show fabrication of all structural-steel components.
- D. Submit Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - E. Welding certificates.
 - F. Mill test reports for structural steel, including chemical and physical properties.
- G. Structural steel framing exposed to View
 1. All copes, miters, and butt cuts in surfaces exposed to view shall be made with uniform gaps of 1/8 inch if detailed to be open joints, or in uniform contact if shown without gap.
 2. Fill low spots and sand smooth to match adjacent surfaces. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
 3. Remove all temporary fabrications including crane hooks that would be exposed to view in their final assembly. Repair damage to exposed surfaces to match adjacent surfaces.
 4. Where AESS is utilized, a mock-up of the condition, or conditions, shall be provided in order to set the quality standards
 5. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.
 6. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, [seam marks, roller marks, rolled trade names,] and roughness.
- H. QUALITY ASSURANCE (new construction and full modernizations)
 1. Shop-Painting Applicators must be qualified according to AISC's Sophisticated Paint Endorsement, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
 2. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - a. 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.
 3. Comply with applicable provisions of the following specifications and documents:

- a. AISC 303 (Code of Standard Practice for Structural steel Buildings and Bridges).
 - b. AISC 341 & AISC 341s1 (Seismic Provisions for Structural Steel Buildings).
 - c. AISC 360 (Specification for Structural Steel Buildings).
 - d. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- I. STRUCTURAL-STEEL MATERIALS
1. W-Shapes: ASTM A99 for SLRS (seismic load resisting system) components due to its tighter yield-to-rupture ratios. ASTM A572 for typical non-SLRS beams.
- J. Channels, Angles: ASTM A36.
1. Plate and Bar: ASTM A36 and ASTM A572, Grade 50, as designated on documents
 2. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B.
 3. Welding Electrodes: Comply with AWS requirements.
- K. FABRICATION
1. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 2. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 3. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
 4. SHOP CONNECTIONS
 - a. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
 - b. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 5. SOURCE QUALITY CONTROL
 - a. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
- L. ERECTION
1. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
 2. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 3. FIELD CONNECTIONS
 - a. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
 - b. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 4. FIELD QUALITY CONTROL
 - a. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds.

05-31-00**Metal Deck**

- A. Includes:
1. Roof deck.

2. Composite floor deck.
 - a. Acoustic deck.
- B. Submit Product Data: For each type of deck, accessory, and product indicated.
- C. Submit Shop Drawings: Show layout and types of deck panels including number of spans, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- E. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- F. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
 1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS) Grade 33, with G90 galvanized coating.
- G. METAL DECK INSTALLATION
 1. Fasten metal-deck panels to steel supporting members by $\frac{3}{4}$ " diameter arc spot (puddle) welds or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long or per Basis of Design Manufacturer's requirements.
 2. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated on drawings
 3. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches.
- H. FIELD QUALITY CONTROL
 1. Testing Agency: Owner will engage a qualified independent special inspection agency to perform field tests and inspections and prepare test reports.

05-40-00**Cold Formed Metal Framing**

- A. Includes:
 1. Exterior load-bearing wall framing.
 2. Interior load-bearing wall framing.
 3. Exterior non-load-bearing walls. Note: This would relate to walls taking wind load, but not "weight-bearing" walls.
- B. Submit Product Data: For each type of cold-formed metal framing product and accessory indicated.
- C. Submit Shop Drawings: Show layout, spacing, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
- E. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- F. MANUFACTURERS
- G. Must be members of SSMA or SFIA.

- H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - a. The Steel Network (<http://www.steelnetwork.com>)
 - b. SCAFCO Corporation.
 - c. United Metal Products, Inc.
 - d. Clark Dietrich
 - e. Steeler
- I. MATERIALS
 - 1. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and minimum G60 galvanized coating.
 - a. Steel Studs: ASTM C955, G90 coating.
 - b. Exterior Z-furring: G185 coating, minimum 18 gauge.
- J. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- K. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- L. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
 - 2. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 3. Cut framing members by sawing or shearing; do not torch cut.
 - 4. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
- M. FIELD QUALITY CONTROL
 - 1. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

05-50-00**Metal Fabrications**

- A. Steel Ladders and Stairs:
 - 1. All ladders and stairs to meet OSHA requirements.
 - 2. Permanent ladders/stairs shall be provided at all roof access hatches where feasible.
 - 3. In new construction and where feasible in existing construction, locate ladders to hatches within custodial closets. Where not feasible, provide permanent ladder with lockable shroud.
 - 4. Provide ladders/stairs between changes in levels on roofs and within attic spaces.
 - 5. Fabricate from standard shapes and size as detailed, and as required to comply with code. All welds ground smooth and flush. Furnish complete with all fittings, brackets, sleeves and hardware required for installation. Provide rounded edges to prevent injuries and improve grip-ability.
- B. Bollards and Barriers

1. Provide 4'-0" exposed steel pipe with welded steel cap, 3" square tube with 1'-6" embed including ½" dia. Anchor through base
 2. Set in 2'-0" deep x 18" dia. concrete footing.
 3. Always slope concrete to drain away from bollards.
- C. Mount Ives 401 wall stop to 3" dia. Steel plate at top of pipe.
- Chain barriers shall no longer be installed. Provide swinging metal gates when access needs to be controlled.
- D. Theatre Catwalks and Galleries (High Schools). Refer to section 05-52-61 below.

05-52-00**Handrails, Guardrails and Decorative Metal Railings**

- A. Existing guardrails, handrails and decorative metal should be evaluated for current life-safety codes and accessibility requirements. Determine whether it is an issue that needs to be mitigated given those factors, historic significance, and cost.
- B. Reference appropriate Historic Renovation standards and guidelines for railings in historic contexts.
- C. All handrail and guardrail designs shall be simple, deter skateboarding, have durable finishes, be aesthetically pleasing and complementary to the school design and era.
- D. Handrails, guardrails, and ladders shall conform to OSHA standards and IBC requirements.
- E. Provide kick guards at open landings and balconies.
- F. Accessibility Requirements: In addition to requirements of authorities having jurisdiction, provide metal fabrications that comply with ADA-AG.
- G. For K-5 and K-8 schools, provide double handrail per the "PORTLAND PUBLIC SCHOOLS ELEMENTARY SCHOOL ADA STANDARDS".
- H. Finish – Coordinate with section 09-91
 1. Provide stainless steel or exposed galvanized whenever possible for finishes to eliminate need for future painting and maintenance. Balance this with historic and aesthetic requirements/sensitivities.
 2. When painted, provide high-performance coating of VOC compliant urethanes to provide balance of a durable finish and ability to maintain. Thoroughly clean and prime prior to paint if applied.
 3. District typically discourages the use of powder coated finishes unless in a location where damage, chipping, etc. is unlikely to occur.
 4. Exterior metal to be exposed galvanized finish except where required for special aesthetic conditions such as historic contexts. Where painted exterior metal is to be used, see 09-97-00 High Performance Steel Coatings.
 5. Where field welding or other damage to galvanization occurs, restore damaged surfaces in accordance with zinc-rich, galvanic, rust-inhibitive primer meeting ASTM A780, *Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings*, .
- I. Installation. Ensure code requirements for strength are met. The following are typical guidelines and may vary based on specific designs.
 1. Curbs shall typically be at least 8" thick for secure attachment. At existing curbs less than 8" thick, provide a structural analysis.
 2. Core Drilling (Preferred)
 - a. This can be done in newly cured or existing concrete.
 - b. New curbs: Concrete curbs and walls are to be a minimum of 8" inches thick.
 - c. Set vertical posts 4'-0" maximum distance apart.

- d. Core-drill concrete surfaces for posts when handrail systems are installed after the three-week concrete curing period.
3. Inserted Sleeves
 - a. Typically, 2" Schedule 40 NPS sleeves at a minimum of 6" long for handrail systems need to be placed in concrete prior to the completion of a three-week curing period.
 - b. Use a non-shrink grout or epoxy filler to set handrail posts into pipe sleeves.
4. Direct Mount
 - a. Recommended at existing curbs only: Flange and bolt railing systems are acceptable where concrete curb walls are less than 8" thick.
- J. Guardrails Integral to Theatre Catwalks and Galleries. (High Schools). Refer to section 05-52-61 below.

05-52-61 Theatre Catwalks and Galleries

- A. Main Theatre
 1. Assumes a standard 500 seat theatre with a stage loft not exceeding 50'-0" in height, with stage loft beams supporting the roof structure and the stage rigging sets. Assumes rigging head blocks and loft blocks are underhung from loft roof beams.
 2. Guards in Performing Arts Assembly Spaces shall conform to OSSC 1013, including exceptions for stages, raised platforms, stage runways, stage ramps, side stages, stage openings, elevated walking surfaces for stage lighting and stage equipment and in assembly seating areas where guards in accordance with Section 1028.14 are permitted and provided.
 3. Catwalks Above Audience
 - a. Stage lighting Catwalks spanning across theatre width in minimum of two locations, with optional third location on special project approval only. Each catwalk shall be approximately 75' long across auditorium internal wall width.
 - b. First catwalk is 24" inside width and is 2'-0" away from proscenium face.
 - c. Second catwalk is 60" inside width and is 20'-0" away from proscenium face.
 - d. Optional third catwalk is 60" inside width and is 36'-0" away from proscenium face.
 - e. All have C12 stringers supported on 8'-0" centers by 3" SQ HSS verticals that weld to face of C12. HSS supports are located at both sides of catwalk. HSS supports shall not be evenly mirrored at centerline of proscenium opening, with no HSS at actual centerline. Split into two equal spaces.
 - f. (3) rows of 1.5" ID SCH40 steel pipe for guard on side away from stage.
 - g. (2) rows of 1.5" ID SCH40 steel pipe for guard on side facing stage, plus a swag of chain with rated links between each vertical HSS. Uppermost of two pipes shall be on outrigger arms at 16" outboard toward stage, from centerline of other pipe rails below.
 - h. Pipe rails are welded or bolted to vertical & horizontal outrigger HSS members.
 - i. A 2" x 2" angle spanning between all HSS on inside face, welded, at +7'-0" above deck, for support of electrical distribution raceway.
 - j. Second, or optional third catwalk (when included), shall have 1/8" dia x 2" SQ WWM between center pair of HSS supports, and in two additional space bays at left and right of center, with one space bay between each side location and the center location. These shall be for use of followspots.
 - k. Diagonal bracing between lateral and front to back HSS members, internal to catwalk footprint, starting at +7'-0" above deck.

- l. Floor is $\frac{3}{4}$ " plywood tekscrewed to corrugated steel pan that spans between stringers, sitting on angles welded to inner face of C12 stringers.
 - m. All finished black.
 - n. Catwalks must not bounce or wiggle when walked upon.
4. Rigging / Loading / Lighting Galleries Onstage
- a. One on each side of stage, at 24'-0" above stage floor, provide a heavy-duty catwalk called "Mid-Gallery". Both are 5'-0" wide (min) and clear span from front wall of stage to rear wall, on two WF members
 - b. Deck is concrete poured over corrugated steel pan, setting on WF members and having intermediate supports underneath.
 - c. Mid-Galleries must support live load of not less than 6000 lbs uniformly spread out.
 - d. Pipe railings on both sides, two plus a chain. Vertical pipes on not greater than 6'-0" horiz centers.
 - e. Must comply with lateral force resistance for fall safety. See OSSC for guards.
 - f. On stage rigging counterweight side, at +36'-0" above stage, provide a similar gallery called "Loading Gallery". It spans from proscenium wall to stage rear wall, not less than 5'-0" wide, and is rated for 24,000 lbs of live load, uniformly spread. Foot print is same as the gallery below it.
 - g. Railings and basic construction for Loading Gallery are similar to other galleries. Free span with no columns below or above.
 - h. Placement of offstage faces of Mid-Gallery and Loading Gallery adjacent to counterweight rigging arbors is critical. Must be near enough for student easy reach to manage counterweights on arbors, yet far enough to avoid rubbing of operating handline on metal framing members.
- B. Drama Classroom / Black Box
- 1. Assumes a teaching space, dark wall and ceiling finish, with rehearsal wood floor, perimeter catwalk and two mid-span crossing catwalks (creating 3 open space bays between), elevated 30" higher than perimeter catwalk, and control booth space at catwalk level (WC Accessible).
 - 2. Guards in Performing Arts Assembly Spaces shall conform to OSSC 1013, including exceptions for stages, raised platforms, stage runways, stage ramps, side stages, stage openings, elevated walking surfaces for stage lighting and stage equipment and in assembly seating areas where guards in accordance with Section 1028.14 are permitted and provided.
 - 3. Perimeter Catwalk
 - a. Stage lighting Catwalk around entire perimeter of room, with one side at double width to allow integration of an AVL control counter as an overlook position.
 - b. 3 sides of perimeter catwalk shall have not less than 36" clear width from wall to guard rail pipes. Control counter side shall have not less than 72" clear width from wall to guard rail pipes.
 - c. All have C12 stringers supported on 8'-0" centers and corners by 3" SQ HSS verticals that weld to face of C12 on room center side of catwalks. Wall side of catwalk shall have C12 mounted to wall as a ledger.
 - d. Wall side of catwalks require no guard rail pipes.
 - e. (2) rows of 1.5" ID SCH40 steel pipe for guard on side facing stage, plus a swag of chain with rated links between each vertical HSS. Top of upper pipe shall be +42" above catwalk deck.

- f. A lower 1.5" ID SCH40 steel pipe supported parallel to, and at -6" below the bottom flange of the C12 stringer on the inside face of the catwalk
 - g. Pipe rails are welded or bolted to vertical HSS members.
 - h. A 2" x 2" angle spanning between all HSS on inside face, welded, at +7'-0" above deck, for support of electrical distribution raceway.
 - i. Diagonal bracing between lateral and front to back HSS members, internal to catwalk footprint, starting at +7'-0" above deck.
 - j. Floor is 3/4" plywood tekscrewed to corrugated steel pan that spans between stringers, sitting on angles welded to inner face of C12 stringers.
 - k. Provide modesty panel of expanded metal mesh at lower 2/3 of inside face of railing pipe system along Control Counter segment of catwalk, where counter will be fabricated.
 - l. All finished black.
 - m. Catwalks must not bounce or wiggle when walked upon.
4. Crossing Catwalks
- a. Stage lighting Catwalk spanning between two of the 36" wide parallel perimeter catwalk segments, with open spaces equidistant between the third 36" wide perimeter catwalk and the Control Counter 72" wide catwalk.
 - b. Set deck level at 30" higher than perimeter catwalk deck.
 - c. All have C12 stringers supported on 8'-0" centers and ends by 3" SQ HSS verticals that weld to face of C12 on each side of catwalks.
 - d. (2) rows of 1.5" ID SCH40 steel pipe for guard on both sides, plus a swag of chain with rated links between each vertical HSS. Top of upper pipe shall be +42" above catwalk deck.
 - e. Pipe rails are welded or bolted to vertical HSS members.
 - f. A 2" x 2" angle spanning between all HSS on inside face, welded, at +7'-0" above deck, for support of electrical distribution raceway.
 - g. Diagonal bracing between lateral and front to back HSS members, internal to catwalk footprint, starting at +7'-0" above deck.
 - h. Floor is 3/4" plywood tekscrewed to corrugated steel pan that spans between stringers, sitting on angles welded to inner face of C12 stringers.
 - i. All finished black.
- Catwalks must not bounce or wiggle when walked upon