

Concrete Materials

- Hydraulic Cement:
• ASTM C150 Type I or Type III, unless otherwise specified.
Fly Ash:
• May replace a portion of Portland cement with approval from the architect and structural engineer.
• Must comply with ASTM C618 Class C or F.
• Maximum replacement amounts are provided in the concrete table.
Normal-Weight Aggregate:
• Must comply with ASTM C33.
• Material certificates from the supplier must be submitted with the concrete mix design.
• River rock or pea stone aggregates are **not allowed**.
Water:
• Must comply with ASTM C1602.

Chloride Ion Limits

- To protect reinforcement from corrosion, maximum water-soluble chloride ion concentrations in hardened concrete (28-42 days), contributed from all ingredients, must not exceed limits shown in the concrete table.

Placement

- Concrete shall be placed carefully to avoid displacing reinforcement.
• Proper vibration is required, especially around post-tensioned anchorages and congested areas (e.g., column joints).
• Placement shall be completed within 90 minutes of adding mixing water, per ASTM C94.
• Tolerances shall conform to the latest edition of ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.

Concrete Table – Interior Slabs on Ground

Table with 8 columns: Element, f'c (psi), Exposure Category, Max. CL, Max. Fly Ash, Max. W/CM Ratio, Max. Coarse Aggregate Size, Min. Air Content. Row 1: Interior Slabs on Ground, 3,500, Ho-30, P(W)0, C1, 0.30, 20%, 0.45, 1", N/A.

Finishing

- Bull floating shall be completed before accumulation of bleed water on the surface.
• Final finishing should only begin after the bleed water has evaporated and the surface sheen disappears.
• Wet trowelling may weaken the surface and cause crazing and dusting.
• Follow architectural requirements for final finishing (e.g., steel trowel, broom finish).

8. Bleed Water Management

- Bleed water (free water at the surface) must be removed to avoid dilution of cement near the surface, which reduces strength.
• Methods include dragging the surface with a garden hose.

9. Control Joints

- Saw-cut control joints, if required, shall be made as soon as the concrete can support the weight of workers and equipment.

10. Curing

- Slabs must be cured for minimum 7 days immediately after finishing:
I. Curing Compound: Apply a water-based dissipating resin type that breaks down after ~4 weeks. Must conform to ASTM C509 Type O or 1D, Class B. Apply in two coats at right angles for complete coverage.
II. Wet Cure: Keep the surface continuously wet after finishing.

11. Cracking

- All concrete will crack, even with proper design and construction.
• Plastic shrinkage cracks occur within the first few days; they may widen up to 50% of final size within ~30 days and continue to develop for up to one year.
• Cracks smaller than 0.06" are usually inconsequential.
• Cracks wider than 0.06" may indicate issues with mix, placement, finishing, or curing and may require epoxy repair or replacement.

Causes of plastic shrinkage cracks: Rapid drying due to hot weather, high wind, low humidity, or delayed curing application.

12. Water Addition on Site

- No water shall be added to mix trucks in excess of the volume withheld by the ready-mix supplier.
• Before adding water, confirm that the slump is below tolerance and the ready-mix supplier had indicated the withheld water volume.

Floor Flatness and Levelness Specifications

Overall Flatness and Levelness (SOF<sub>F</sub> / SOF<sub>L</sub>)

Overall Flatness and Levelness (SOF<sub>F</sub> / SOF<sub>L</sub>)

- The specified overall flatness (SOF<sub>F</sub>) and overall levelness (SOF<sub>L</sub>) values shall conform to the table below, based on the floor surface classification and slab category:

Table with 4 columns: Classification, SOF<sub>F</sub>, SOF<sub>L</sub>, Typical Applicability. Rows: A. Conventional, B. Moderately Flat, C. Flat, D. Very Flat, E. Super Flat.

A

Minimum Local Flatness and Levelness (MLF<sub>F</sub> / MLF<sub>L</sub>)

- Minimum local flatness (MLF<sub>F</sub>) and levelness (MLF<sub>L</sub>) shall be 3/5 of the SOF<sub>F</sub> and SOF<sub>L</sub> values, unless noted otherwise.
• For industrial slabs, MLF<sub>F</sub> = 23 and MLF<sub>L</sub> = 17.
• The MLF<sub>F</sub> and MLF<sub>L</sub> values apply to the smallest areas defined by:
I. Column lines and half-column lines, or
II. Construction and contraction joints, whichever results in smaller areas.

Applicability of Tolerances

- SOF<sub>F</sub> and MLF<sub>F</sub> tolerances apply only to:
• Level slabs-on-ground, or
• Level, uncambered suspended slabs that are shored to prevent deflection from placement until measurement.

Sloped Slabs

- Slabs specified to slope shall have a tolerance of ±3/8" in 10 feet at any point from the specified slope.

Structural Steel Specifications

General

Fabrication and Erection

- All structural steel shall be fabricated and erected in accordance with the latest edition of AISC 360 – Specification for Structural Steel Buildings.

Protection

- Steel within permanently conditioned, non-corrosive spaces inside the building envelope does not require shop painting unless exposed to the elements for one year or more during construction.
• Steel in unconditioned spaces or outside the building envelope must be either:
• Hot-dip galvanized, or
• Painted with zinc-rich paint.
The contractor shall prepare steel according to the selected protection method.
• Galvanization Requirements:
• Steel members, fabrications, and welded assemblies shall be galvanized after fabrication via hot-dip in accordance with ASTM A123.
• Zinc coating weight shall meet ASTM A123 or ASTM A386 ("Weight of Coating") requirements.
• Field-welded portions of galvanized assemblies shall be repaired with zinc-rich corrosion-resistant paint.
• Closed shapes (e.g., tubes, pipes) requiring holes for fabrication shall have the hole filled with weld material and repaired after galvanization, or sealed with exterior-grade sealant.

Fireproofing

- Steel members to receive fireproofing shall not be primed or painted.
• Fireproofing thickness shall be increased for members not meeting minimum UL-rated sizes or for unrestrained members, per the UL Fire Resistance Directory – Volume 1.

Camber

- Beams shall be cambered upward where indicated in the contract documents.
• If no camber is shown, any mill camber shall be detailed upward.

Notifications and Penetrations

- Notify the structural engineer of misfabricated steel prior to erection.
• Penetrations shall not be cut unless shown on the drawings or approved by the engineer.

Materials

- All hot-rolled steel plates, shapes, and bars shall be new and conform to ASTM A6 (latest edition).

Table with 2 columns: Member Type, Specification. Rows: W-Shape, Channels, Angles, Plates, Rectangular HSS, Round HSS.

Submittals

- Structural steel submittals must be accompanied by the SDS/2 or Tekla model for visual reference to the shop drawings.
• Shop drawings must comply with the AISC Code of Standard Practice.

Connections

Connection Design

- All steel connections not fully detailed in the drawings shall be designed by a contractor-hired connection engineer who is a licensed professional in the project state.
• Connection details shown are conceptual; the final design, including plate/angle thickness and bolt quantity, is the responsibility of the connection engineer.

Structural Bolts

- Conform to ASTM A325 Type 1, unless noted otherwise.

Threaded Rods

- Conform to ASTM F1554 Gr. 55 S1.

Welding

- Electrodes shall conform to:
• SMAW – E70XX
• SAW – F7XX-EXX
• GMAW – ER70S-X
• FCAW – EBXT-X
• Field welds must be performed by certified welders under continuous special inspector supervision.
• Shop welds must be executed in a fabrication shop certified by the AHJ.

Anchor Rods

- Conform to ASTM F1554, typical size 3/4" Ø, embedded min. 1'-0", with heavy hex nut unless noted otherwise.
• Grade 55 S1 unless otherwise specified.

Grout

- Use non-metallic, non-shrink grout with minimum compressive strength 6,000 psi when bearing on 53,000 psi concrete.

Splicing

- Steel splicing not shown on drawings is prohibited without EOR approval.

Headed Concrete Stud Anchors (HSA)

- Use Nelson or KSM anchors (or approved alternative), per ASTM A108, Grades C-1010 to C-1020.
• Anchors shall be automatically end-welded using suitable shop or field welding equipment.

Deformed Bar Anchors (DBA)

- Use Nelson or KSM anchors (or approved alternative), made from cold-drawn wire per ASTM A496, minimum yield 70 ksi.
• Anchors shall be automatically end-welded per manufacturer recommendations.

Fillet Weld Sizes (Minimum, unless noted)

Table with 2 columns: Thinner Material Thickness (t), Fillet Weld Size. Rows: 3/16", 1/4", 3/16", 3/8", 7/16", 1/2", 3/4", >3/4".

Wood Framing Specifications

General

- Wood framing sizes, firestops, anchorage, lurring, and connectors not shown on the construction documents shall, at a minimum, adhere to prescriptive design requirements per the building code.

Structural Lumber – Permanently Conditioned Spaces

Structural lumber in permanently conditioned spaces shall meet or exceed the following grades, species, and product lines:

Studs

- Stud grade Southern Yellow Pine
• Stud grade Douglas Fir-Larch
• Vertical studs may use certified finger-jointed Hem-Fir, Southern Pine, or Douglas Fir
• HRA (Heat Resistant Adhesive) required for studs in fire-resistance rated assemblies.

Joists

- No.2 grade Southern Yellow Pine
• No.2 grade Douglas Fir-Larch

Laminated Veneer Lumber (LVL) – Beam/Header/Girder

- Weyerhaeuser 2.0E Microlam LVL
• Boise Cascade Verso-Lam 2.0E, 3100Fb

Glued Laminated (Glulam) – Beam/Header/Girder

- 3/8" & 5/8" wide: Anthony Power Beam 3000Fb – 2.1E – 300Fv
• 7" wide: Anthony Power Beam 2800Fb – 2.1E – 300Fv

Rafters

- No.2 grade Southern Yellow Pine
• No.2 grade Douglas Fir-Larch
• No.2 grade Structural Finger-Jointed Hem-Fir, Southern Pine, or Douglas Fir
• HRA designation required in fire-rated assemblies.

Posts

- Dimensional lumber/limbs: No.2 grade Southern Yellow Pine or Douglas Fir-Larch
• Parallel Strand Lumber (PSL): TrusJoist 1.8E Parallam PSL posts

Plates

- No.3 grade Southern Yellow Pine
• No.3 grade Douglas Fir-Larch

Blocking

- No.3 grade Southern Yellow Pine
• No.3 grade Douglas Fir-Larch

Structural Lumber – Non-Permanently Conditioned Spaces

Dimensional Lumber

- Same species and grades as above, pressure-treated.

Glued Laminated (Glulam) Beams/Headers/Girders

- Power Preserved Glulam Beam (24F-VSM1/SP) treated with:
• CopperGuard at 0.04 pct, or
• Clear-Guard at 0.055 pct

Wood Structural Panels

General

- Used for siding, roof/wall sheathing, subflooring, diaphragms, and built-up members.
• Shall be APA performance-rated per DOC PS 1, DOC PS 2, or ANSI/APA PRP 210.
• Panels must display grade, bond classification, and performance category by an approved grading agency.
• Performance category value shall be used as nominal panel thickness. Panel Types
• Subfloor: 23/32" APA-rated Sturd-I-Floor, 24" o.c., Exposure 1
• Sheathing/Decking: 7/16" APA-rated sheathing, 32/16, Exposure 1 (unless noted otherwise, see shear wall schedule)

Exterior Exposure

- Panels permanently exposed outdoors must be exterior type, except roof sheathing exposed on underside may be Exposure 1 type.

Moisture and Drying

- All lumber shall be kiln-dried to a maximum moisture content of 19%.

Glued Laminated (Glulam) Members

- Shall comply with ANSI A190.1 and ASTM D3737.
• Typical manufacturer: Anthony Power Beam, 3000Fb – 2.1E.

Lumber Identification

- All lumber shall bear the grade mark from a grading or inspection agency accredited per DOC PS 20.

Preservative Treatment and Fasteners

- All wood in contact with concrete or exposed to weather must be preservative-treated.
• All fasteners (anchor bolts, power-actuated fasteners, nails, clips, hangers) attached to treated wood must be approved for the environment.

Nails and Staples

- Shall conform to ASTM F1647.
• Minimum coverage bending yield strengths:
Shank Diameter | Minimum Bending Yield Strength (f<sub>b</sub>)
1" | 0.177 – 0.254" (4.50 – 6.45 mm) | 80 ksi (551 MPa)
0.142 – 0.177" (3.61 – 4.50 mm) | 90 ksi (620 MPa)
0.099 – 0.142" (2.51 – 3.61 mm) | 100 ksi (689 MPa)

Fasteners for Fire-Retardant Treated Wood

- Must be hot-dipped galvanized steel or stainless steel.

Wood Truss Specifications

Design

- Trusses shall be designed by the truss manufacturer in accordance with:
• Truss Plate Institute (TPI) – National Design Standard for Metal Plate Connected Wood Truss Construction (ANSI/TPI 1-2014)
• International Building Code (IBC §2303.4)
• The design shall include:
• All temporary and permanent bracing. Temporary bracing may remain in place if it does not interfere with architectural requirements.

Submittals

- The truss manufacturer shall prepare a truss submittal package including:
• Product data
• Shop drawings
• Submittal process:
• Manufacturer submits package to the contractor.
• Contractor reviews and approves.
• Contractor forwards package to the architect/engineer for review of general conformance with structural drawings.
• Submittals must be prepared, signed, and sealed by an engineer licensed in the project state.
• Package content:
A. Product Data
• ICC approval for framing members and fasteners designed by others
B. Shop Drawings (include at minimum):
• Project name, location, and building code reference
• Layouts, including temporary and permanent bridging
• Truss profiles showing all joints, bearing points, deflection ratios, and reactions
• Blocking requirements
• Required bearing widths
• Number of plies (if 3)
• Lumber species and grade
• Plate size, gauge, and location
• Truss-to-truss hardware requirements
• Name and trademark of plate manufacturer and truss fabricator
• Camber
C. Calculations
• Building code reference
• Design loads
• Stress reduction factors for plates

Drag Trusses

- Stress reduction factors for plates
• Drag trusses shall be provided above and below all interior shear walls.
• Design must support an allowable linear load equal to that of the shear wall.
• If shear walls exist above and below, the larger allowable shear load shall apply. - - -

Truss Restraint and Bracing

- Restraint/bracing shall comply with BC5I-B3 (permanent restraint/bracing of chords and web members) unless noted otherwise.

Truss Deflection Limits

Table with 2 columns: Truss Type, Live Load Limit | Total Load Limit. Rows: Floor Trusses | L/360 | L/240, Pitched Roof Trusses | L/240 | L/180, Shallow Roof Trusses (S 4:12) | L/360 | L/240.

Camber

- Camber shall be built into roof trusses to compensate for vertical deflection.
• Maximum camber occurs at mid-span.

Example:

- Pitched roof truss: Camber = 1.0 × actual dead load deflection

Trusses Spanning ≥ 60 Feet

- The truss manufacturer shall contract with a qualified registered design professional for:
• Design of temporary installation restraint/bracing
• Design of permanent individual truss member restraint/bracing

Wood Shrinkage

General

- All building designs must account for wood shrinkage as framing dries.
• Wood continues to shrink until it reaches its equilibrium moisture content (EMC), typically 8–12% moisture content for most U.S. structures.
• The contractor shall prepare and enforce a moisture control plan to minimize water in wood framing.
• Drywall installation is prohibited until all wood framing has a moisture content below 15%.

Construction Considerations

- Contractors must understand framing tolerances, shrinkage, and interactions with dissimilar materials.
• Rough openings in exterior walls shall be upsized approximately 1/2" to accommodate shrinkage.
• Provide 1/8" wide gaps between sheathing panels.
• Plumbing systems must accommodate differential vertical movement:
• Include vertical expansion joints
• Allow gaps around horizontal runs
• Avoid horizontal runs within load-bearing studs

3. Moisture Control During Construction

- Take precautions to limit moisture exposure of lumber.
• If lumber becomes wet, dry it to ≤15% moisture content before installing finishes.

4. Estimated Wood Shrinkage

- Assumes all lumber is Southern Pine with initial moisture content of 19% and final moisture content of 10%.

Table with 2 columns: Date, Description. Row 1: 12/15/2025, PROGRESS SET.

This project, like most OpeningDesign's projects, is open source. Attribution: ShareAlike 4.0 International - CC BY-SA 4.0 - freely available to any party for future use, assuming the terms such as Attribution and ShareAlike are honored.