

SECTION 03300: CAST-IN-PLACE CONCRETE

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included in This Section: Provisions of all cast-in-place concrete unless otherwise noted, including reinforcing and formwork. Concrete construction shall include slabs and walks.
- B. Related Work Specified Elsewhere: Provisions of furnishing and installation of embedded items including but not necessarily limited to sleeves, inserts, anchors, anchor frames, bolts, etc.

1.02 INCORPORATED DOCUMENTS

The provisions and requirements of the General and Supplementary Conditions and Division-1 Specifications sections of these Bid Documents apply to this section. The Contractor shall be responsible for, and governed by all requirements thereunder.

In addition to the Codes and Standards listed in Section 01000, as well as standards shown on the drawings, the published specifications, standards and methods of the trade cited below shall apply to work of this Section.

Curbs, Gutters, Side Walls and Concrete Paving

- A. Caltrans Standard Specifications, Section 90

All other concrete

- B. American Concrete Institute (ACI)
- C. Concrete Reinforcing Steel Institute (CRSI)

1.03 QUALITY ASSURANCE

- A. Requirements of ACI 301 and 302 shall govern work, materials and equipment related to this Section. Specifications herein set minimum standards for results, guides and references to procedures.
- B. Contractor shall be responsible for quality and surface appearance of concrete placed and shall bear burden of proof that concrete as cast meets minimum strength requirements.

1.04 SUBMITTALS

- A. Mix designs in accordance with Article 2.03.
- B. Record of placing concrete when requested by the Architect.
- C. Shop Drawings: Shop Drawings for reinforcing shall include bending and placing details, size and location of reinforcing, including diagrammatic wall elevations to scale, position and erection marks of bars, marginal bars around openings, dowels, splices, etc.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken until time of use and insure storage facilities are weather tight and dry.
- B. Use sacked cement in chronological order of delivery.

PART 2: PRODUCTS

2.01 CONCRETE CLASSES

See structural drawings for concrete strengths required in various types of construction.

- A. Schedules of Values:
 - 1. Strength: All concrete footings and slabs shall have minimum 3,000 psi compressive strength after 28 days when tested in accordance with ASTM C39.
 - 2. Aggregate: Graded as shown in design mix for each class of concrete, 1-1/2" maximum for footings, 1" maximum for floor slabs.
 - 3. Weight: Not less than 145 pounds per cubic foot.
 - 4. Slump: Maximum slump shall be 4 inches, unless otherwise noted on the Drawings
 - 5. Water/Cement Ratio: Not more than 0.45

2.02 CONCRETE MATERIALS

Cement and aggregates shall be from constant sources with proven history of successful use with one another and shall remain unchanged throughout the work unless otherwise approved. Deviations in properties of materials tested shall be cause for their rejection pending additional test results and redesign of mix by Contractor's Testing Laboratory.

- A. Ready Mix Concrete: ASTM C94
- B. Cements: ASTM C150, Type II, unless noted otherwise on Drawings.
- C. Aggregates: ASTM C33, for Coarse and Fine sand-gravel. ASTM C330 for expanded shale type for lightweight.
- D. Water: Clean, potable, free of impurities detrimental to concrete, and clear when used.
- E. Air entraining admixture as per ASTM C 260 and manufacturer's instructions. Water reducing, retarding, accelerating admixtures as per: ASTM C 494 and manufacturer's instructions. Bonding agent: Polymer

resin. Non-shrink grout: Non-metallic mineral aggregate, cement, water reducing materials as per ASTM C 494 and as per manufacturer's instructions.

Note: Admixtures other than those for air entraining may be used only with prior approval of the Architect and only if listed in the approved mix design.

- F. Curing Materials: Water by fog-spray nozzle and waterproof paper, ASTM C171, Type 1, regular; or sheet plastic, polyethylene, 4 mils thick, fungus resistant.
 - 1. Curing Compounds: May be used provided that the material does not impair bonding of other materials shown or specified to be applied over the concrete surfaces, and with the approval of the Architect. All curing compounds shall conform with the requirements of ACI 305--Hot Weather Concreting, ACI 306--Cold Weather Concreting, ACI 308--Standard Practice for Curing Concrete.
- G. Moisture Barrier: All interior concrete floor slabs on grade shall be placed over a continuous and unbroken 10-mil polyolefin moisture barrier. Joint sealant shall be roofing mastic.

2.03 MIXES

The Contractor shall employ a testing laboratory and instruct that laboratory to base mix designs using materials approved by the Architect. Mix designs shall produce concrete of minimum strengths specified and of uniform density.

- A. General Requirements: Design mixes shall be based on one cubic yard; mixes shall be modified as required to provide specified strengths and workability without changing cement content.
- B. Mix designs shall be subject to review by Architect and Owner's testing agency.
- C. Admixtures will not be permitted unless Architect approves, the testing laboratory modifies mix design accordingly, and the modification is accepted by Owner's testing agency.
- D. Miscellaneous patching mortars, non-shrink grout, etc., as approved shall be mixed in accordance with the manufacturer's instructions, and applied in conformance with published specifications.

2.04 MIXING

Concrete mixing shall comply with referenced standards and in a manner to insure all components are thoroughly mixed to exact proportions stated in the approved mix designs.

- A. Measure fine and coarse aggregates separately to provide accurate control, and adjust only to improve workability maintaining proportions, values or factors of approved mixes. Use automatic metering devices to introduce admixtures into mixes.
- B. Batch Plant Conditions: Equipment and plant shall afford all facilities and acceptable procedures to provide the specified mixes.

2.05 REINFORCING

A. Materials:

1. Reinforcing steel shall be intermediate deformed bars conforming to ASTM A-615 with a #4 or smaller bars grade 40 and #5 or larger grade 60. Splices in the reinforcing steel shall be lapped 40 bar diameters, minimum, unless noted otherwise, field welding or reinforcing steel will not be allowed. Separate bars 1-1/2 bar diameters clear with a minimum of 1-1/2" clear. Fabricating details shall conform to the ACI manual of standard practice. All reinforcing shall have a minimum concrete cover as follows, unless noted otherwise:

Surfaces poured against earth	3"
Formed surfaces exposed to ground or weather	2"

2. Tie Wires: ASTM A82
3. Welded Wire Fabric: ASTM A185
4. Welding Electrodes: Low hydrogen E-70 rods complying with provisions of all applicable Codes.
5. Bar Supports: As required for assembling and supporting reinforcement in place using typically CRSI Class B pre-galvanized.
 - a. Exposed Conditions: CRSI Class C plastic-protected; or Class E stainless steel wire, Type 430.
6. Anchor Bolts: ASTM A-307

B. Fabrication:

1. Shop fabricate and comply with requirements of ACI 315 where specific details are not shown or where drawings and specification are not more demanding.
2. Reinforcing shall not be permitted to rust when there is danger of staining exposed surfaces of concrete. Rust-stained concrete shall be replaced by the Contractor at his expense.
3. Welders shall be qualified in accordance with AWS D1.1.

4. Reinforcing shall be fabricated and placed within limits permitted by ACI 318, Section 7.32 unless otherwise noted or approved by the Architect.

2.06 FORMWORK

- A. Forming Materials for Concealed Surfaces: Contractor's option.
- B. Wood Framing: WCLB standard grade or better Douglas Fir.
- C. Form Ties and Spreaders: Metal type acting as spreaders, leaving no metal within one inch of concrete face and no fractures, spalls, depressions or other disfigurations greater than 3/4" diameter.
- D. Expansion Joint Filler: Fiber Type, pre-moulded asphalt impregnated fiber conforming to ASTM D 1751, thickness as noted.
- E. Form Sealer: Non-staining, non-grain-raising, free of mineral oils or other nondrying ingredients and leaving no bond inhibiting residue on concrete; same as Grace Construction Materials' "Formshield", Concrete Service Materials Co., "Form Coat", or approved equal.
- F. All members supporting their own dead weight, or members exposed to wind, or other external loading shall be properly shored, braced, or restrained to prevent damage. Structural members shall be shored or braced as required for all imposed loads, the details for which shall be reviewed by the Architect prior to beginning any formwork.

PART 3: EXECUTION

3.01 INSPECTION

Examine units of work to be cast and verify that formwork is complete, reinforcement, inserts, embedded items are complete and in place and that lines, levels, depressions are accurately set and the Architect and/or project inspector has approved all preparations.

- A. Do not begin placement of concrete before unsatisfactory conditions have been corrected.

3.02 PREPARATION

Insure availability of sufficient labor, equipment and material, to complete the work scheduled. Protect finish surfaces adjacent to areas of placing or handling of concrete. Soak forms, except sealed plywood, moisten sand cushions and spray forms again immediately before casting. Notify Architect 48 hours before placing of concrete is scheduled and obtain approval before starting.

3.03 PLACING

A. Formwork: Examine areas where formwork will be constructed and verify that excavations are sufficient to permit placement, inspection and removal of forms and that conditions are otherwise proper for formwork with items to be embedded in concrete and other related work.

1. All concrete work shall be formed to the shapes, sizes, lines, and dimensions shown. Particular care shall be exercised in the construction so as to prevent the necessity for cutting or chipping of concrete after it is in place.

a. Apply form sealer to wood forms prior to placing reinforcing steel following approved manufacturer's directions.

2. Forms shall be substantial and properly shored and braced to maintain position and shape. Boards or panels shall be sufficiently tight to prevent leakage of mortar. Protect formwork from undermining.

3. No wood spreaders or wood of any description except nailing blocks will be permitted to remain inside the forms. All inserts, reglets, anchors and other embedded items shall be accurately set and securely attached to forms.

4. Expansion Joints: Provide in exterior concrete slabs on grade at maximum 30-foot centers and at intersections with vertical surfaces, curbs or other penetrations unless otherwise noted. Fiberboard 3/8" thick x slab depth shall be used.

5. Control joints shall be provided as follows, unless otherwise specifically shown on the Drawings:

Concrete 4" thick or less: Maximum 20'-0" on center in any direction.

Concrete thicker than 4": Maximum 15'-0" on center in any direction.

Verify proposed control joint locations with the Architect prior to the placement of concrete. **It shall be understood that control joints located at greater spacing than noted above can be considered sufficient grounds for rejecting the concrete work, which shall be replaced at no additional cost to the Owner.**

a. Control joints shall be saw cut into concrete work as soon as practical, but in no case longer than 12-hours following placement. **It shall be understood that saw cutting taking place later than 12-hours following placement can be considered sufficient grounds for rejecting the concrete work, which shall be replaced at no additional cost to the Owner.**

- b. Control joints shall extend to a depth equal to 1/3 the depth of the concrete. **It shall be understood that saw cuts not meeting this depth can be considered sufficient grounds for rejecting the concrete work, which shall be replaced at no additional cost to the Owner.**
 - c. All saw cutting shall be performed using a walk-behind "Soff Cut" saw, or other similar walk-behind saw designed specifically for this use.
 - 6. Embedded Items: Properly locate and place embedded items required by other trades prior to placing concrete, and provide for provisions of other trades affected by the concrete work.
 - 7. Forms shall be kept wet before placement of concrete.
 - 8. Where soil conditions will permit excavation to accurate sizes without bracing, side forms for footing may be omitted provided dimensions are increased 2" and approval is obtained from the Architect.
- B. Reinforcing:
- 1. Place bars and insure placement will permit concrete protection meeting requirements of ACI 318, supporting and fastening bars securely with spacers, chairs or ties to permit their being walked upon without displacement before and during concrete placement.
 - 2. Wherever conduits, piping, inserts, sleeves, etc. interfere with placement of reinforcing, obtain Architect's approval of layout and method before placement of concrete.
 - 3. Splices, Laps and Hooks shall be made to meet minimum requirements of CRSI, Chapter 6, unless otherwise indicated on the Drawings.
 - 4. Maintain vertical and horizontal laps and splices including extensions and embedments at 40 diameters or 18" minimum, unless otherwise noted on the Drawings.
 - 5. Dowel vertical reinforcing to footings with bars of same size and spacing as vertical bars unless otherwise noted.
 - 6. Welding shall be done only where detailed, comply with AWS D12.1 and insure that equipment supplies proper current and voltage adjusted to suite arrangement and thickness of items welded. Protect welds against rust until time of concrete placement.
- C. Moisture Barrier: Install in accordance with approved manufacturer's recommendations unless specifically noted otherwise.

1. Membrane material shall be applied in the widest practicable widths. Side and end joints shall be lapped at least 1'-0" and shall be closely fitted around pipes, conduits, columns and other protrusions. Areas surrounding protrusions shall be made damp-proof by using small pieces of membrane and a liberal amount of mastic.
 2. Provide protection of moisture barriers from operations which might puncture or otherwise damage them.
 3. Provide 2" minimum sand cushion over moisture barrier. Moisture content of sand shall not exceed 3% at the time of concrete placement. Sand covering shall not be installed until the membrane installation has been inspected and approved by the Architect.
- D. Standard Concrete: Place concrete in accordance with referenced standards, convey concrete as rapidly as possible, casting within one hour of adding water unless otherwise approved. Maintain Placing Record showing date and time of casting concrete in the units of the building.
1. Place concrete in cycles to permit integration, avoid free falls in excess of 8 feet and take precautions to avoid damage to underslab work inserts, and displacement of reinforcement and formwork.
 2. Keep forms and reinforcing clean, remove laitance and when casting is interrupted longer than 45 minutes discontinue casting for remainder of day, cutting back concrete for provision of construction joints. Clean forms and reinforcing for subsequent concrete placement.
 3. Hot Weather Concreting: Meet requirements of ACI 305.
 4. Cold Weather Concreting: Meet requirements of ACI 306.
 5. Consolidating: Mechanically vibrate all footings, walls and grade beams. At least two electrically or gas powered vibrators shall be on site at all times when concrete is being poured.
 6. Construction Joints: Verify location and detail requirements. Provide elsewhere only where designated by the Architect and allow 24-hour elapse per section. In slabs on grade, construction joints shall occur not more than 30 feet apart or as directed.

3.04 FORMWORK REMOVAL

Do not remove formwork until concrete has hardened and attained sufficient strength to permit safe removal of forms, or as required by applicable codes and standards.

- A. Secure the Architect's approval for time of removal of all structural concrete formwork.
- B. Remove forms carefully to avoid damaging corners and edges of exposed concrete and seal immediately as scheduled, noted, or required.
- C. Reuse of forms is permitted provided they are in condition equal to new formwork, and have been cleaned, repaired and resealed.
- D. Care shall be exercised in the removal of forms to avoid damaging the concrete and to insure the complete safety of the structure.
- E. For exposed concrete all tie or metal spreader devices shall be broken back or removed to at least 1" from face. For concrete below grade or concrete covered by furring, the devices may be cut back flush with surfaces. Exposed surfaces of concrete shall be adequately protected at all times from damage due to temperature changes and action of the elements.

3.05 CURING

- A. Provide for curing of concrete as per ACI 308 for a minimum of seven days. Start curing procedures promptly after pour, to protect concrete from premature drying. Control curing methods, covers, and wetting, with special attention to weather conditions.
- B. During curing, protect concrete from heat or cold, to maintain temperature between 50 and 70 F. degrees. Protect concrete from inclement weather, running water, construction equipment, movement and load stress.

3.06 CLEANING, PATCHING AND DEFECTIVE WORK

- A. General: Clean immediately after stripping and patch defects with patching mortar. Replace unacceptable, under-strength, out-of-line, out-of-level or out-of-plumb concrete without cost to the Owner.
- B. Repair of Surface Defects:
 - 1. Repair all surface defects including tie holes, minor honeycombing and otherwise defective concrete with cement mortar. Cement mortar for patching shall be the same composition as that used in the concrete, except that for exposed surfaces part of the cement shall be white portland cement to provide a finish color matching the surrounding concrete. Patching shall be done as soon as the forms are removed. Clean thoroughly all areas to be patched.
 - 2. Minor honeycombed or otherwise defective areas shall be cut out to solid concrete to a depth of not less than one inch. The edges of the cut shall be perpendicular to the surface of the concrete.

Saturate the area to be patched and at least 6 inches adjacent thereto with water before placing the mortar. Mix the mortar approximately one hour before placing and re-mix occasionally during this period with a trowel without the additional of water. A grout of cement and water mixed to the consistency of paint shall then be brushed onto the surfaces to which the mortar is to be bonded. The mortar shall be compacted into place and screeded slightly higher than the surrounding surface. Finish patches on exposed surfaces to match the adjoining surfaces. Cure patches as specified for the concrete.

3.07 CONCRETE FINISHES

A. General:

1. All concrete floor slabs shall be of monolithic construction and reinforced as shown on drawings. The finish shall be true to line and plane within a tolerance of 1/8" when tested with a 10 foot straight edge.
2. Concrete walks shall have score lines at equally spaced intervals, approximately 8'-0" apart and expansion joints at maximum 30'-0" intervals or as shown on the drawings. All exposed edges to have 1/4" tooled radius.
3. The typical finishes listed herein may not all occur on this project. Consult Drawings and Finish Schedule for finishes required.

B. Interior Finishes:

Steel Troweled: Dense, smooth, hard steel-troweled surface, monolithic. After initial set, work with wood float followed by two steel trowelings. Use for all interior floor slabs with floor coverings or floor coatings, or as otherwise noted.

C. Exterior Finishes:

Float Sweat: Dense, smooth machine troweled to true surface required. After initial set work with a wood float on a combination of float and steel hand trowel to lift cement paste and fine aggregate to the surface. Use a clean push broom to apply medium broom texture perpendicular to the length of the concrete. Final finish shall be slip-resistant. Use for typical exterior slabs.

End Of Section 03300