

SECTION 03 10 00
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SCOPE

- A. Includes furnishing all materials, equipment, transportation and facilities, and performing all labor necessary for constructing concrete formwork.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to Work of this Section.
- C. Alternate bids: Refer to other sections for description.

1.2 CODES AND STANDARDS

- A. The Work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the codes in effect at the time of permitting and specifications.
 - 1. ACI 301, Specifications for Structural Concrete of Buildings.
 - 2. ACI 318, Building Code Requirements for Reinforced Concrete Buildings.
 - 3. ACI 347, Recommended Practice for Concrete Formwork.
 - 4. U.S. Product Standard for Softwood Plywood, Construction and Industrial PS-1.
 - 5. Timber Construction Manual, American Institute of Timber Construction.
 - 6. Design of Wood Formwork for Concrete Structures, National Forest Products Association.

1.3 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. The design and engineering of formwork and shoring, as well as its construction, shall be the responsibility of the Contractor.
 - 2. Design criteria shall conform to ACI 347, Chapter 2.

B. Allowable Tolerances:

1. Except when close coordination and fitting of various trades' work precludes allowance of tolerance, maximum total permissible deviations from established line, grades and dimensions shall conform to ACI 347, Section 3.3. Set and maintain forms in such manner as to ensure completed work within specified tolerance limits.
2. Variation in location of embedded structural items unless provided with sleeves or other means of adjustment: 1/4".

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 33.
- B. Shop Drawings: Submit a diagram of proposed construction joints not indicated on Drawings prior to or concurrent with reinforcing steel shop drawings.
 1. Shop drawings will be reviewed for proposed construction joint locations with respect to aesthetic criteria and general design conformance only.
- C. Product Data: Submit complete manufacturer's product data sheets for each specified product.
- D. Shoring: Provide drawings and calculations for shoring of formwork in accordance with ACI 347, Section 2.1.5. The shoring drawings and calculations shall be signed and sealed by an engineer in the state of the location of the project.

1.5 STORAGE OF MATERIALS

- A. Store form materials and accessories on dunnage and under cover with protective sheeting.

1.6 SCHEDULING/SEQUENCING

- A. Coordinate Work of this Section with work of other Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other Sections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. FORMS: Wood, metal and other approved material that will not adversely affect surface of concrete and will provide or facilitate obtaining specified surface

finish:

1. Wood forms for unexposed concrete surfaces shall be built of No. 2 Common Southern Yellow Pine lumber or other material of equal qualifications, of sufficient thickness to be capable of sustaining the loads to be imposed thereon, dressed to uniformly smooth contact surfaces and so constructed as to be readily removable.
 2. Metal forms shall be clean, unpainted and in excellent condition. Forms shall at all times be straight to provide members of the widths and depths required. Damaged or indented forms will not be acceptable.
 3. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces.
 - a. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - i. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
 - ii. Wood forms for exposed concrete shall be medium density overlay, Class 1 or better; mill-release agent treated and sealed.
 4. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
 5. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- B. Form release agent shall be non-residual, non-staining chemical release agent containing no kerosene, meeting Corps of Engineer Specification CE-204 requirements. Test for non-staining of concrete. Release agent shall not impair subsequent treatments of concrete surfaces.
- C. Corner Chamfer: 3/4 inch polyvinyl chloride form strip equal to CSF type as manufactured by The Burke Company or wood chamfers.
- D. Form ties for exposed concrete surfaces shall be manufactured to allow a positive breakback of no less than one inch (1") inside the concrete surface. Ties shall be equipped with a plastic cone of not less than five-eighths inch (5/8") diameter and one inch (1") long which will completely cover the hole and prevent the leakage

of any mortar. Form ties for unexposed surfaces shall be bolt rods or patented devices having a minimum tensile strength of three thousand (3,000) pounds when fully assembled. Ties shall be adjustable in length and free of lugs, cones, washers or other features which would leave a hole larger than seven-eighths inch (7/8") in diameter, or depressions back of the exposed surface of the concrete. Ties shall be of such construction that, when the forms are removed, there will be no metal remaining within one inch (1") of the finished surface of the concrete. Ties shall be designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

- E. Vapor Retarder: 10 mil thick "Stego-Wrap" by Stego Industries or equal. Maximum moisture vapor permeance of 0.036 perms per ASTM E1745, Class A.
- F. Form Sealer: Synthex by Industrial Synthetics Corp., or Pre-Form by Nox-Crete Co.
- G. Compressible Filler: Premolded Sponge Rubber and Cork, non-asphaltic, ASTM D1752, Type 1.
- H. Waterstops: Synko-Flex Preformed Plastic Waterstop of Synko-Flex Products Co., meeting requirements of FS SS-S-00210.
- I. Construction Joint Form: The Burke Company "Keyed-Kold Joint" or equal.
- J. Dovetail Anchor Slots: No. 305 galvanized steel 22 gage, by Hohmann and Bernard, Inc., or similar by Richmond or Burke.
- K. Soil Retainer Board: Motz Block, Sure Retainer, or approved equal, durable to withstand soil and water contact without deterioration.

PART 3 - EXECUTION

3.1 MATERIAL STORAGE

- A. Form material shall be delivered to the job site as far in advance of its use as is practical, and shall be carefully stacked clear of the ground in such a manner as to facilitate air drying.

3.2 INSTALLATION

- A. All concrete members shall be adequately shored to safely support all loads and lateral pressures outlined in "Recommended Practice for Concrete Formwork" (ACI 347), without distortion, excessive deflection and other damage.
- B. All necessary forms, centering, shores and moulds shall be built to conform to the shapes, lines and dimensions of the various members of concrete construction, as

shown or scheduled on the Drawings. They shall be sufficiently tight and so substantially assembled as to prevent bulging or the leakage of mortar. All forms shall be assembled to facilitate their removal without damage to the concrete.

- C. Provide temporary openings at the bottom of cast-in-place walls, columns and elsewhere as required to facilitate cleaning, drainage and inspection.
- D. Construct forms with such care as to produce concrete surfaces which will not have unsightly or objectionable form marks in exposed (concrete) surfaces. Lumber once used as forms shall have all contact surfaces thoroughly cleaned before reuse.

3.03 FORM TIES

- A. Form ties shall be employed in such places and at such intervals as to securely hold the forms in position during the placing of concrete, and to withstand the weight and pressure of the wet concrete. Ties of a type intended to be entirely removed shall be coated with release agent to safeguard against damaging the concrete during such removal. The use of wire ties will not be permitted.

3.04 WOOD STRIPS, BLOCKINGS AND MOULDINGS

- A. Place in the forms wood strips, blocking, moulding, nailers, etc., as required to produce the finished profiles and surfaces shown on the Drawings and to provide nailing for wood members or other features required to be attached to concrete surfaces in such manner. Coat wood strips, blocking, and mouldings with release agent.

3.05 CHAMFERS

- A. All exposed external angles of concrete members shall have 3/4" chamfer strips placed in the forms to relieve the angles.

3.06 FORM COATING

- A. Treat forms with release agent. Wipe excess off to leave surface of forms just oily to touch. Assure that release agent is not applied to reinforcing steel nor allowed to contact hardened concrete against which fresh concrete will be placed.

3.07 CONSTRUCTION JOINT

- A. Except as otherwise specifically indicated on the Drawings, each concrete member shall be considered as a single unit of operation, and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, the same shall be located in the middle third of spans.

- B. Additional construction joints shall not be made under any circumstances without prior evaluation by the Architect. All construction joints must be either plumb or level. Provide appropriate keys and dowels in all construction joints, whether horizontal or vertical.

3.08 JOINT TREATMENT

- A. Gasket, plug, tape or caulk joints, gaps and apertures in exposed concrete forms to positively prevent leakage. Form joints allowed only where indicated on shop drawings. Where possible, locate joints behind rustication. Apply joint treatment within 24 hours of scheduled pour.

3.09 CLEANING

- A. Immediately before placing concrete, clean forms free of chips, sawdust, wire clippings and other debris.

3.10 INSERTS AND ACCESSORIES

- A. Make provisions for required installation of accessories, bolts, hangers, sleeves, anchor or dovetail slots, and inserts cast in concrete.
- B. Obtain templates or instructions for installation of items.
- C. Place expansion joint fillers where detailed.

3.11 WALLS AND COLUMNS

- A. Construct concrete walls and columns to the heights, thicknesses and profiles shown on the Drawings. Provide temporary openings at the bottom of all wall and column forms to facilitate cleaning and inspection. Close such openings securely, immediately in advance of pouring concrete in the wall forms. Provide appropriate keys and haunches in walls to receive edge of concrete floors.

3.12 WATERSTOPS

- A. Provide continuous water stops in all joints at and below grade. Position waterstops accurately and support against displacement. Splice sections watertight in accordance with manufacturer's recommendations.

3.13 VAPOR RETARDER

- A. Install vapor retarder under all concrete floor slabs on grade including terrace and courtyard and elsewhere as indicated. Smooth subgrade to prevent protrusions that may cause damage or rupture of films.

- B. Lay film using widest practical widths. Lap edges of film not less than six inches (6") with top lap placed in the direction of the concrete flow. Cut film carefully around all pipes and wiring outlets and seal with pressure sensitive tape.

3.14 BEAMS AND JOISTS

- A. Concrete beams and joists shall be of sizes and shapes as shown.
- B. Forms may be reconditioned and reused if they meet all other specification requirements.

3.15 SLABS

- A. Form all openings in concrete slabs as required for the vertical passage of ducts, pipes, conduits, etc.

3.16 MISCELLANEOUS

- A. Construct forms for any and all items of concrete work required for or in connection with the satisfactory completion of the project, whether each such item is specifically shown or referred to or not.
- B. Do not sleeve any columns, beams, or slabs unless such sleeves are indicated on the Structural Drawings, or are previously approved on Shop Drawings by the Structural Engineer.

3.17 REMOVAL OF FORMS

- A. Forms shall not be removed until the concrete has adequately hardened and set. Clamps or tie rods may be loosened twenty-four (24) hours after the concrete is placed; ties, except for a sufficient number to hold the forms in place, may be removed at that time. Throughwall ties that are to be wholly withdrawn shall be pulled toward the inside face of the respective wall or beam. Cutting ties back from the face of the concrete will not be permitted, and care shall be exercised to avoid spalling concrete surfaces.
- B. Formwork for concrete members that support the weight of concrete shall remain in place until the concrete has reached 75% of its specified 28-day strength, unless otherwise specified or permitted. All shoring and reshoring shall comply with ACI 318, ACI 301, and ACI 347.
- C. Under normal conditions, the minimum period of time to be allowed to elapse before forms may be removed shall be as indicated in ACI 347, but its observance shall not operate to relieve the Contractor of the responsibility for the safety of the structure. Deviations shall be submitted to and reviewed by the Architect prior to

removal of forms.

- D. When the temperature falls below forty degrees Fahrenheit (40 degrees F.), the forms shall remain in place an additional period equal to the time the structure has been exposed to such lower temperature. Adequate measures shall be taken to protect the concrete from cold weather conditions.
- E. Contractor shall pay for and have Testing Laboratory make additional test cylinders to confirm strength requirements for early form removal. Alternately, the in situ strength of concrete may be determined by the maturity method following the requirements of ASTM C1074.
- F. Adequately reshore members subject to additional loads during construction to support both member and construction loads in a manner that will protect member from damage. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement. Contractor shall pay for and have Testing Laboratory make additional test cylinders to confirm strength requirements for early form recovery. Reshore before removing original shoring. Reshoring shall remain in place until members have attained required compressive strength, or as long as required to support additional construction loads.
- G. When reshoring is required, the operations shall be planned in advance and shall be the responsibility of the Contractor.
- H. Reshoring shall remain in place until members have attained required compressive strength, or as long as required to support additional construction loads.
- I. Reference Contract Documents for Additional Shoring Requirements at Cantilevers.

3.18 FORM REUSAGE

- A. Thoroughly clean surfaces of forms and remove nails before reuse. Do not reuse damaged or worn forms. Inspect forms and re-tighten rustications.
- B. Recoat contact surfaces of forms and liners with a light spray coat of release agent. Do not apply until after joint treatment is complete.

END OF SECTION