SPECIFICATIONS - DETAILED PROVISIONS
Section 03150 – Formwork for Cast-in-Place Concrete

C O N T E N T S

SECTION 03150
FORMWORK FOR CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

Provide formwork for cast-in-place concrete as indicated, specified, and required.

A. Work Included in This Section. Principal items are:

1. Furnishing, erection, and removal of forms.

2. Shoring and bracing of formwork.

3. Setting of embedded items, and in non-waterbearing locations setting of pipe sleeves for mechanical and electrical work under direction of respective trade requiring holes for passage of pipe or conduit.

B. Related Work Not Included in This Section.

1. Furnishing embedded items with setting instruction. (Section 03300)

2. Reinforcement. (Section 03200)

3. Concrete mixing, placing and finishing. (Section 03300)

4. Waterstops. (Section 03300)

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies. The requirements of California Construction Safety Orders Section 1717 apply to the Work of this Section, and the Contractor shall prepare and maintain at least one copy of the required drawings at the site. The District will not approve the drawings and the Contractor shall submit evidence to the California Division of Occupational Health and Safety to justify the formwork and shoring designs. Design of the structures shown on the Drawings does not include any allowance or consideration for imposed construction loads. Contractor's shoring and formwork drawings shall be filed with the District for record purposes only and not for review or approval. Forms, shoring and falsework shall be adequate for imposed live and dead loads, including equipment, height of concrete drop, concrete and foundation pressures, stresses, lateral stability, and other safety factors during construction.

B. Standards and Tolerances. Formwork shall comply with ACI 347R-88 Recommended Practice for Concrete Formwork, except as exceeded by the requirements of regulatory agencies or as otherwise indicated or specified. Except as such other requirements mandate more rigid tolerances, formwork shall be designed and constructed to produce finished concrete conforming to tolerances given in ACI 117-90.

1.03 SUBMITTALS

Concrete construction joints and expansion joints shall be of the types and locations indicated. Submit shop drawings showing sequence of forming and concrete placing operations, and location and type of required construction of any proposed expansion joints not shown on the Drawings. Submit shop drawings at least fifteen (15) working days in advance of form fabrication.

PART 2 - PRODUCT

2.01 FORM COATING

Non-grain-raising and non-staining resin or polymer type that will not leave residual matter on surface of concrete or adversely affect bonding to concrete of paint, plaster, mortar, protective coatings, waterproofing or other applied materials. Coatings containing mineral oils, paraffins, waxes, or other non-drying ingredients are not permitted. For concrete surfaces contacting potable stored water, the coatings and form-release agents shall be completely non-toxic.

2.02 LUMBER

WWPA No. 1 Structural Light Framing or No. 1 Structural Joists and Planks, or equal. Board forms, if used, shall be No. 2 Common or better, T&G or shiplap, S1S2E or better.

2.03 PLYWOOD

Plywood shall conform to U.S. Product Standard PS-1 and shall bear APA or DFPA grade mark.

A. General Use. Exterior type, Grade B-B Plyform, Class I, minimum 5/8" thickness. Mill-oiling is not permitted.

B. Special Use. Use one or more of the following materials, or equal:

1. HDO coating two sides on Plyform, Class I, Exterior.

2. Exterior Type Grade B-B Plyform, Class I, having 1/8" thick fully adhesive bonded facing on one side of tempered structural hardboard.

3. Birch hardwood plywood, all plies of Arctic white birch, panel faces on both sides phenolic plastic impregnated and faced with phenolic plastic by the hot press process, panel edges factory sealed, bearing manufacturer's logo in lieu of grade mark.

2.04 METAL FORMS

True to detail, good condition, clean, free from dents, bends, rust and oil, and of adequate size as approved by the Engineer.

2.05 ROUND COLUMN FORMS

Structural quality fiberboard, metal tubes as specified for metal forms, or fibrous glass reinforced plastic.

2.06 METAL FORM TIES

Prefabricated rod, snap-off, or threaded internal disconnecting type of tensile strength to resist all imposed loads. Ties shall leave no metal within 1½" of concrete surfaces after removal. Snap-off type ties shall have integral washer spreaders of diameter to fully close tie holes in forms. In waterbearing structures, ties shall be equipped with an integral waterstop which shall remain in place.

2.07 FORM JOINT SEALERS

For joints between form panels, use resilient foam rubber strips, nonhardening plastic type caulking compound free of oil, or waterproof pressure-sensitive plastic tape of minimum 8-mil thickness and 2" width. For form tie holes, use rubber plugs, plastic caulking compound, or equal.

2.08 MOLDS

For grooves, drips, rebates, profiles, chamfers, and similar items, use smooth milled pine or douglas fir coated with specified form coating, or standard product extruded polymer plastic units of the indicated or required shapes.

PART 3 - EXECUTION

3.01 FORM TYPES

A. Smooth Surface Concrete. Use specified plywood or metal forms, as approved, for interior and exterior exposed concrete and all formed concrete in contact with liquids, waterproofing and protective coatings. Metal forms shall be lined with plywood.

B. General Concrete. Use either plywood or board forms for concealed surfaces, or form as specified for smooth surface concrete. Metal forms for general concrete need not be lined with plywood.

C. Approval. Metal forms shall be furnished to the jobsite sufficiently in advance of construction for detailed inspection by the Engineer. Forms showing evidence of worn connections of tie-holes, damaged or warped surfaces, or any other unsatisfactory feature shall be ordered removed from the jobsite by the Contractor, and shall not be returned to the jobsite. Metal forms, faced forms, and other forms shall be maintained in good condition through the construction period, and when in the opinion of the Engineer this is no longer the case, the unsatisfactory material will be removed from the jobsite.

1. Refer to Section 03300 for approval of form placement.

3.02 SHORING AND FALSEWORK

Distribute loads properly over base area on which shoring is erected, either concrete slabs or ground; if on ground, protect against undermining or settlement, particularly against wetting of soils.

A. Alignment. Construct forms to produce in finished structure all lines, grades, and camber as required.

B. Camber. Provide jacks, wedges, or similar means to induce camber and to take any settlement in formwork which may occur either before or during placing of concrete. Camber for beams and slabs shall be as and where indicated. Perform screening in such manner as to maintain beam depths and slab thicknesses.

3.03 FORM CONSTRUCTION

Build forms to exact shapes, sizes, lines, and dimensions as required to obtain accurate alignment, location and grades, and level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, joint screeds, bulkheads, anchorages, and other required features. Make forms easily removable without hammering or prying against concrete. Use metal spreaders to provide accurate spreading of forms. Construct forms so that no sagging, leakage, or displacement occurs during and after pouring of concrete. Coat forms with specified coating material only prior to placement of reinforcing steel; do not allow coating to contact reinforcing bars. Provide l-foot minimum clear opening over form for finishing concrete.

A. Chamfers. Provide 3/4 inch x 3/4 inch chamfer strips for all exposed concrete corners and edges unless otherwise indicated.

B. Recesses, Drips and Profiles. Provide types shown and required.

C. Form Joints and Tie Holes. Seal joints between form panels with specified foam plastic strips, caulking compound, or tape. Unless form tie spreaders fully seal tie holes in forms, seal around ties with specified materials and prevent leakage of concrete mortar.

D. Form Windows. Provide windows in forms wherever directed or necessary for access for concrete placement and vibration. Windows shall be of size adequate for tremies and vibrators, spaced at maximum 6 foot centers, horizontally. Windows shall be tightly closed and sealed before placing next lift of concrete.

E. Cleanouts and Cleaning. Provide temporary openings in wall and column forms for cleaning and inspection. Prior to pouring, clean all forms and surfaces to receive concrete.

F. Reglets and Rebates. Properly form all required reglets and rebates to receive flashing, frames, and other equipment. Dimensions, details, and precise positions of all such reglets and rebates shall be ascertained from the trades whose work is related to or contingent upon same, and the concrete work formed accordingly.

G. Re-use. Clean and recondition form material before each re-use. Unsatisfactory material shall be rejected and removed from the site.

3.04 EMBEDDED PIPING AND ROUGH HARDWARE

All trades which require openings for the passage of pipes, conduits, and other inserts shall be consulted and the necessary pipe sleeves, anchors, or other required inserts shall be properly and accurately installed. Openings required by other trades shall be reinforced as indicated and required. Conduits or pipes shall be located so as not to reduce the strength of the construction, and in no case shall pipes other than conduits be placed in a slab 4½" or less in thickness. Conduit embedded in a concrete slab shall not have an outside diameter greater than one-third of the thickness of the slab nor be placed below bottom reinforcing steel or over top reinforcing steel. Conduits may be embedded in walls provided they are not larger in outside diameter than one-third the thickness of the wall, are not spaced closer than three diameters on center, and do not impair the strength of the structure. All conduit, piping and other wall penetrations or reinforcements shall be subject to District's policy and approval.

3.05 FIELD QUALITY CONTROL

A. Inspection of Forms. Refer to Article 3.01 C for approval requirements for forms prior to use, and to Article 3.05 B for requirements during concrete pours. Refer to Section "Cast-In-Place Concrete" for approval requirements for placement of forms.

B. Control During Concrete Placement. Devices of the tell-tale type shall be installed on supported forms and elsewhere as required to detect formwork movements and deflection during concrete placement; plumb-bobs shall be utilized on forms for all walls and columns eight (8) feet or more in height. Required slab and beam cambers shall be checked and correctly maintained as concrete loads are applied on forms. Workmen shall be assigned to check forms during concrete placement and to promptly seal all mortar leaks.

3.06 REMOVAL OF FORMS AND SHORING

Do not remove forms or shoring until concrete has attained sufficient strength to support its own weight and all imposed construction and permanent loads. Any damage to the work resulting from early removal of forms or shoring or early imposed loading shall be corrected at no added expense to the District.

A. Form Removal. Minimum times for removal after concrete placement are as follows:

Beam sides (but not shoring) ..... 3 days
Column forms and wall forms ..... 2 days
Forms for supported roof or floor slabs (but not shoring) ..... 14 days
Forms for slabs on grade ..... 2 days

B. Shoring and Falsework Removal. Do not remove shoring and falsework until twenty-one (21) days after concrete placement or until concrete has attained at least 90 percent of the twenty-eight (28) day design compressive strength as demonstrated by control test cylinders, whichever is earlier, but not sooner than fourteen (14) days.

C. Restriction. Do not impose construction, equipment, or permanent loads on columns, supported slabs, or supported beams until concrete has attained the twenty-eight (28) day design compressive strength.

D. Concrete Curing During Removals. Concrete shall be thoroughly wetted as soon as forms are first loosened and shall be kept wet during the removal operations and until curing media is applied. Potable water supply with hoses shall be ready at each removal location before removal operations are commenced. Contractor shall bear costs and delays caused by any damage resulting from early removal of forms or shoring. Refer to Section "Cast-In-Place Concrete" for curing requirements.

END OF SECTION 03150