SECTION 03 10 00 (CHANGE ORDER)

CONCRETE FORMWORK

PART 1 – GENERAL

1.01 DESCRIPTION

A. This specification section governs the furnishing, installing and removing of formworkto confine and shape concrete, including shoring and form supports, and installation of embedded items.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements

B. Section 03 20 00 – Concrete Reinforcement

C. Section 03 30 00 – Cast-In-Place Concrete

1.03 REFERENCED CODES AND STANDARDS

A. American Concrete Institute (ACI) Standards

1. 301-10 – Specifications for Structural Concrete

2. 318-11 – Building Code Requirements for Structural Concrete

3. 347-04 – Guide to Formwork for Concrete

4. SP-15 – Field Reference Manual: Specifications for Structural Concrete (ACI301-10) with Selected ACI and ASTM References

B. The Engineered Wood Association PS-1 – Construction and Industrial Plywood.

1.04 SUBMITTALS

A. Form-Facing Materials: Submit data on form-facing materials proposed if differentfrom that specified in Section 2.01 of this specification.

B. Construction and Contraction Joints: Submit location and detail of construction andcontraction joints if different from those indicated in Contract Drawings.

C. Reshoring and Backshoring Procedure: Before using reshoring or backshoring that isrequired or permitted, submit procedure, including drawings signed and

sealed by a professional civil or structural engineer experienced in design of this work and is licensed in the State of California. Include on shop drawings formwork removal procedure and magnitude of construction loads permitted during reshoring and backshoring.

D. Submit manufacturer's data sheet on the following:

1. Formwork release agent

2. Form liner

3. Form ties

4. Expansion joint materials

5. Waterstop materials and splices

6. Manufacturer's information on formwork, form materials, and locations for use. (Applies to concrete thrust blocks only).

E. Structural: Detailed plans for the fabrication and erection of formwork to be used. Such plans shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the formwork, means of protecting existing construction which supports formwork, and typical soil conditions. Include a list of form materials and locations for use. (Applies to concrete thrust blocks only).

1.05 QUALITY CONTROL

A. Design formwork under direct supervision of a professional civil or structural engineerexperienced in design of this work and is licensed in the State of California.

B. Allowable tolerances shall be in accordance with the requirements of ACI 347 unlessotherwise noted on Contract Drawings or specified.

C. Maintain copies of all applicable Codes and Standards at the project site at all times.

D. Conform to the requirements of the Division of Industrial Safety, State of California,and all other codes and regulations.

E. Before placing concrete, check lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of the forming systems.

F. All embed items, including anchor bolts, headed studs, plates, etc., shall be fully secured prior to placing concrete.

G. During concrete placement, check formwork and related supports to ensure forms are not displaced and that completed work will be within specified tolerances.

1.06 CONTRACTOR'S QUALIFICATIONS

A. The contractor shall have a minimum of 5 years of proven experience for installing formwork in similar construction. Submit job history to include description, quantity,owner, engineer, addresses and telephone numbers of references.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products in accordance with manufacturer'sinstruction.

B. Store materials in a manner that will preclude any damage or deterioration andprovide easy access for inspection and identification of each item.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Form-Facing Materials

1. General: Form face material in contact with concrete shall be lumber, plywood, tempered concrete-form-grade hardboard, metal, plastic, or paperthat creates specified appearance and texture of concrete surface.

2. Exposed Surfaces:

a. APA grade-stamped "B-B Plyform, Class I, Exterior" douglas fir plywood;minimum ¾ inch thick; each piece grade marked; clean, smooth, uniformin size and free of raised grain, torn surfaces, worn edges, patches or other defects; no mill oiling permitted.

1. Metal forms shall be of smooth metal plate free of surface irregularities, of an acceptable type for the class of work involved, and of the thicknessand design required for rigid construction. Unexposed Surfaces: Made of wood, metal, or other acceptable material. Wood forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots; plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be of anacceptable

type for the class of work involved and of the thickness and design required for rigid construction.

2. Curved Surfaces: Form with metal, plywood, or adequately supported, surfaced and matched Douglas fir boards not more than 4-inches wide.

B. Formwork Accessories

1. Form Ties: Metal, removable to a depth of at least 1-1/2 inches below the surface of the concrete. Ties shall be of sufficient strength to prevent the spreading of the forms during concrete placement. The use of wire ties willnot be permitted.

2. Form Release Agents: Use an approved non-staining coating which will permit the ready release of forms and which will not affect application of applied finishes. Form release agents containing mineral oils or petroleumsolvents such as paraffin will not be permitted. Use specially formulated coatings for metal forms to prevent rust stains on concrete.

3. Chamfer Strips: Except as noted on Contract Drawings and at flush joints between concrete and other construction, provide ¾ inch triangular wood orplastic strips, place and secure in forms at external corners.

4. Expansion and Isolation Joint Material: Preformed, ½ inch thick, conformingto ASTM D994.

5. Waterstop Material: Waterstop material shall be manufactured byGreenstreak or approved equal.

a. Dumbbell Waterstop: Shall be 3/8-inch thick by 9-inch wide
b. Swellable Waterstop: Shall be hydrolite CJ-Type

C. All other materials, not specifically described, but required for proper completion of concrete formwork, shall be as selected by Contractor and subject to the approval ofthe City Representative.

PART 3 – EXECUTION

3.01 PREPARATION

A. Contractor shall conform to the recommendations in ACI 318, Chapter 6.

B. Vertical and Horizontal Controls: Establish and maintain necessary benchmarks,lines, or controls throughout construction.

C. Obtain necessary information and provide for openings, sleeves, chases, pipes, recesses, nailers, anchors, ties, inserts, and similar embedded items. Coordinatewith concrete and other related work for requirements governing embedment andsleeving of pipes and conduit.Obtain written approval from the City Representative before framing openings notshown on Contract Drawings.

3.02 CONSTRUCTION OF FORMS

A. General:

1. Construct formwork to produce concrete surfaces conforming to tolerances inACI 301. Construct formwork to the exact shapes, lines and dimensions of concrete members, arranged to allow erection in proper sequence and to permit removal without damage to concrete finish.

2. Unless otherwise indicated on Contract Drawings, construct formwork panelsin sections as large as practicable. Construct forms of boards or plywood of same widths, shapes, and design for accurate location of form joints as indicated on the shop drawings. Fasten together with cleats; joists and studsmay be used, at Contractor's option, in lieu of cleats if required for structural integrity of formwork. Verify clear space between forms to insure allowable coverage for reinforcing steel and allowable tolerances for construction.

B. Framing and Bracing: Framing, bracing and supporting members shall be of ample size and strength to safely carry, without excessive deflection (exceeding allowable tolerances), all dead and live loads to which formwork may be subjected, and shall beplaced sufficiently close to prevent any apparent bulging or sagging of forms.

C. Exposed Concrete Surfaces:

1. Make plywood panel patterns regular and symmetrical, joints plumb andlevel, horizontal joints continuous. Control reuse of forms for exposed surfaces to provide surface of uniform color and texture without sharp demarcation between adjacent surfaces.

2. Form ties for exposed concrete surfaces shall be arranged symmetrically andshall be aligned both vertically and horizontally (do not stagger).

3. In general, provide ¾-inch chamfer at corners for exposed concrete unless otherwise noted. At chamfers, the concrete cover for reinforcement is criticaland the minimum specified thickness shall strictly apply.

4. Edges of all form panels in contact with concrete shall be flush within

1/32- inch and form for plane surfaces shall be such that the concrete will be planewithin 1/16-inch in 4 ft. Form joints shall be tight to prevent the passage of mortar, water and grout.

D. Embedded Items: Contractor shall secure all inserts, bolts, plates, and other embedded items. Use templates for equipment anchor bolts and other embeddeditems where final alignment is critical. Fill voids with readily removable material toprevent entry of concrete.

E. Waterproofing Conditions: Concrete surfaces to receive waterproofing and damp- proofing materials shall be formed to provide a relatively smooth surface free of sharpcorners, projections, and offsets at form joints. Form ties shall not penetrate or damage applied waterproofing and damp-proofing.Camber forms for slabs and beams as required for compensating deflection of form members. Positive means of adjustment (wedges or jacks) of shores and struts shallbe provided to permit realignment or readjustment.

F. Forms for walls of considerable height shall be arranged with tremies and hoppers forplacing concrete in a manner that will prevent segregation and accumulation of hardened concrete on the forms or reinforcements above the fresh concrete.

G. Provide temporary openings at bottom of forms where necessary to facilitate cleaningand inspection before concrete placement. Provide blockouts for mechanical and electrical work wherever necessary.

H. Provide forms for footings wherever concrete cannot be placed against solid earthexcavation.

I. Construction joints and expansion joints shall be provided where indicated on the Contract Drawings. Otherwise, Contractor shall provide the layout for review andapproval.

3.03 APPLICATION OF FORM COATINGS

A. Thoroughly clean forms and coat with approved form–coating material prior to initialuse and before each reuse. Excess form coating material shall not stand in puddlesin the forms nor shall such coating come in contact with hardened concrete against which fresh concrete is to be placed.

B. Apply form–coating material before reinforcing steel, anchoring devices and embedded items are placed and in strict accordance with manufacturer's directions.

3.04 FALSEWORK

A. Contractor shall be fully responsible for the proper strength, safety of the falsework,supports and bearing surfaces which are used in connection with

the work. Falsework shall be designed to support imposed loads without deformation, deflection or settlement.

B. Wedges in pairs or jacks shall be used where required to maintain and/or adjust forms and formwork for beams, slabs and other parts of the structure at exact elevations. To ensure uniform bearing, single wedges are not permitted. Complywith requirements of ACI 347.

C. Vertical and lateral loads shall be carried to ground by falsework framing, or by the completed structure after it has attained the requisite strength. Falsework supports,when placed on ground, shall be protected against undermining or settlement.

3.05 REMOVAL OF FORMS AND FALSEWORK

A. Responsibility: The sole responsibility for removal of forms/falsework and for any resulting structural or finish damage rests with the Contractor. If forms are to remain,The Contractor shall adhere to all governing requirements and/or recommendations.

B. The removal of forms and falsework shall be carried out in such manner as to ensurethe complete safety of the structure. Supports shall not be removed until members have sufficient strength to safely support their own weight and all superimposed loadings with proper factor of safety.Unless otherwise specified in the Drawings, the minimum time for forms to remain inplace shall be:

1. Side forms for footings, foundations, slabs on grade, or other components that do not resist bending shall not be removed in less than 48 hours after concrete placement. At times of low temperature or other adverse weatherconditions, the Engineer may increase the required time to five days.

2. The falsework and forms supporting concrete girders, beams, joists, slabs, walls, or other members subject to bending stress, shall not be removed or released in less than 14 days after the concrete has been placed. In any case, the falsework and forms supporting the members shall not be removeduntil the concrete has attained a compressive strength of at least 75% of thedesign strength based on test results of field cured cylinders. Furthermore, such members shall not be loaded until the concrete has attained its 28-day compressive strength.

C. All forms, supports, and falsework shall be arranged so that they may be readilyremoved without hammering or prying against the concrete.

D. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shallbe filled, and surface defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.

3.06 REUSE OF FORMS

A. Reuse of forms will be accepted, providing they are in good condition and have beencleaned, repaired, and resealed as required to achieve concrete of the specified quality and texture. Do not reuse form facing more than four times.

END OF SECTION