DIVISION 03 – CONCRETE

SPECIFICATION 0310000: FORMS AND FORMWORK

PART 1.0 GENERAL

1.1 DESCRIPTION

The work of this specification includes furnishing of all labor, materials, equipment and incidentals to install, adjust, and remove all formwork required for the forming of cast-in-place concrete, as shown on the Construction Drawings and as specified herein. Forms shall be either wood or steel designed to meet the conditions specified herein.

1.2 REFERENCE DOCUMENTS

- American Concrete Institute (ACI)
- American National Standards Institute (ANSI)
- National Institute of Standards and Technology (NIST)
- Codes and regulations of jurisdictional authorities

1.3 SUBMITTALS

1.3.1 Submit manufacturer's literature for form coating proposed for use.

1.3.2 Submit formwork layout plans, design data, and procedures certified by a Florida Registered Structural Engineer when requested by the Project Manager.

1.3.3 Submit a copy of any design exception prior to installation. Design exceptions are issued by the Utility Design Section Manager. Any deviation from the specifications requires a design exception.

1.4 RELATED WORK

- Specification 032000, Concrete Reinforcement
- Specification 033000, Cast-In-Place Concrete
- Hillsborough County Standard Pump Station Drawings
- Specification 333003, Wastewater Pumping Stations

PART 2.0 PRODUCT

2.1 QUALITY ASSURANCE

2.1.1 The formwork shall be designed and erected in accordance with ACI 301"Standard Specification for Structural Concrete" and ACI 318" Building Code requirements for Reinforced Concrete" for the loads, lateral pressure, and allowable stresses outlined in "Recommended Practice for Concrete Formwork", ACI 347 and for design considerations, wind loads, allowable stresses and other applicable requirements of the local building code. The design and construction of the formwork shall be the responsibility of the Contractor. Form design shall be certified by a Registered Structural Engineer.

2.1.2 The formwork shall be true in every respect to produce hardened concrete to the required shape, size, grade, and alignment as indicated on the Construction Drawings, and of sufficient strength, bracing, and rigidity to maintain their position and shape under the loads and operations incidental to placing and curing the concrete, as well as other forces resulting from the movement of the forms. The forms shall be mortar-tight at the time concrete is placed in them and shall be so constructed that the surfaces of the finished concrete will be reasonably free from ridges, fins, offsets, or similar defects. Adequate and suitable means for removing the forms without injury to the surfaces or edges of the finished concrete shall be provided.

2.1.3 Formwork shall be constructed such that the hardened surfaces shall conform to the tolerance limits of ACI 347.

2.2 FORMS AND ACCESSORIES

2.2.1 Plywood forms will be grade marked Exterior Grade, B-B Concrete Form or High Density Overlay (HDO) Concrete Form B-B, conforming to the requirements of the NIST Voluntary Product Standard PS-1, Plywood.

2.2.2 Metal Forms will use smooth metal plate free of surface irregularities.

2.2.3 Hardboard forms will be tempered, smooth one side, not less than 3/16 inch thick conforming to the requirements of ANSI 135.4, Basic Hardboard.

2.2.4 Form ties will be factory fabricated, snap-off metal type of adequate design to minimize form deflection and preclude concrete spalling upon removal.

2.2.5 Form ties will be fabricated so that set back in the concrete is such that the portion of the tie remaining after snap-off and removal of the exterior portions is at least 1-1/2 inches back from the concrete surface.

2.2.6 Form coating will be non-grain-raising and non-staining resin or polymer type that will not leave residual matter on the surface of the concrete or adversely affect bonding to concrete of paint, plaster, mortar, protective coatings, waterproofing or other applied materials. Coatings containing mineral oils, paraffin, and 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 and approved by the EPA for the intended use.

2.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

Store and handle form coating to prevent contamination of coating in accordance with manufacturer's recommendation.

PART 3.0 EXECUTION

3.1 FABRICATION

3.1.1 Use forms that conform to ACI 347. Fabricate with facing materials that produce the specified tolerance requirements of ACI Special Publication No. 4, Formwork for Concrete, produce true surfaces, sharp corners and true lines and are free of offsets, ridges, bulging, waves and concave or convex areas.

3.1.2 Use regular and uniform pattern; long dimension of panels vertical; joints horizontal, vertical and aligned; form ties uniformly spaced and aligned in horizontal and vertical rows.

3.2 PREPARATION

3.2.1 Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. All surfaces of forms and embedded materials shall be cleaned of any mortar from previous concreting and of all other foreign material or water before coating is placed on them.

3.2.2 Forms shall be coated in accordance with manufacturer's recommendations before the form or reinforcement is placed in final position. Surplus coating on form surfaces, or any coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.3 INSTALLATION, REMOVAL, AND SHORING

3.3.1 Installation of forms will comply with the following requirements:

3.3.1.1 Forms shall be sufficiently tight to prevent loss of mortar from the concrete, set true to the lines and elevations indicated on the Drawings, tied, and braced to remain true during and after concrete placement within tolerances of Part 2.1 of this Specification. The Project Manager may at any time condemn any section or sections of forms found deficient in any respect, and such form shall be promptly removed and replaced.

3.3.1.2 No wooden spreaders shall be allowed to remain in the concrete.

3.3.1.3 Place chamfer strips in forms to bevel all corners, edges, joints and other structural elements exposed to views, including use of dummy chamfer and false joints to provide neat and uniform appearance. Exposed corners and edges shall have one-inch by one-inch - 45 degree chamfers, unless otherwise indicated on the Construction Drawings.

3.3.1.4 Provide temporary openings at the base of wall forms and at the other points when necessary to facilitate cleaning and inspection immediately before depositing concrete.

3.3.1.5 Secure in position wedges used for final alignment and items to be embedded in concrete.

3.3.1.6 Forms for keyways shall be prepared in advance of pouring concrete. Keyway forms in slab edges and vertical wall joints shall be rigidly secured in place before the concrete is poured. Forms for keyways for horizontal joints in walls may be placed at the conclusion of the pour, but proper provision shall be made for obtaining and holding the full depth and form of the keyway.

3.3.2 Adjustment of forms will comply with the following requirements:

3.3.2.1 Positive means of adjustment shall be provided to permit realignment or readjustment of shores if excessive settlement occurs.

3.3.2.2 A pair of wedges may be used at the top or bottom of shores, but not at both ends, to facilitate vertical adjustment, to correct uneven settlements, or to facilitate dismantling of the formwork.

3.3.2.3 Screw jacks for pipe shores or scaffold-type shoring may be used both top and bottom so long as they are secured by the shore or scaffold leg against loosening or falling out, to avoid lateral deflections.

3.3.2.4 During and after concreting, but before initial set of the concrete, the elevations, camber, and plumbness of formwork systems shall be checked, using telltale devices. Appropriate adjustments shall be promptly made where necessary. If, during construction, any weakness develops and the formwork shows any undue settlement or distortion, the Work shall be stopped, the affected construction removed if permanently

damaged, and the formwork strengthened.

3.4 EMBEDDED ITEMS

3.4.1 Items to be embedded in concrete shall be free from oil or foreign matter that would weaken the bonding of the concrete to these items.

3.4.2 Install in the formwork requisite inserts, anchors, sleeves, and other items specified under other sections of these Specifications. Close ends of conduits, piping, and sleeves embedded in concrete with caps or plugs.

3.4.3 Concrete pads, curbs, pedestals, and similar means devised by the Contractor to support the forms will be subject to review by the Project Manager.

3.4.4 Before depositing concrete, check the location and support of items which are to be wholly or partially embedded.

3.4.5 Place reinforcement so that there will be a clear distance of at least two inches between the reinforcement and any anchor bolts or other embedded metal work.

3.5 FIELD QUALITY CONTROL

3.5.1 Construct elements to meet the allowable tolerances of the dimensions, elevations, and positions specified in Specification 033000.

3.5.2 Deposit concrete only when the forms and placement of the reinforcement has been checked and approved by the Project Manager. The Contractor shall provide notice to the Project Manager at least 24 hours in advance of any contemplated concrete pour.

3.6 JOINTS

3.6.1 Unless otherwise directed, make contraction, expansion, and construction joints only where shown.

3.6.2 Continue reinforcing steel and wire fabric across construction joints which are not indicated as being free to move.

3.7 REMOVAL OF FORMS, FALSE WORK, AND CENTERING

3.7.1 Maintain forms, false work, and centering in place until the concrete has attained the minimum percentage of specified design strength for the structural members to carry their own weight and any loads to which they will be subjected without exceeding the permissible stresses and without deforming.

3.7.2 Maintain forms, false work, and centering in place until the concrete has attained the minimum percentage of specified design strength listed in the following table.

Minimum Percent of Specified Design Strength

Structural Member	Schedule 1
Footings: Inverts; sides of beams, slabs and girders; slabs and beams on grade	25%
Open cut structure exterior walls; retaining walls	50%
Soffits and beams, slabs and girders under 20 feet clear span between supports	80%
Cantilevers and intersecting sections	90%

3.7.3 Remove forms, false work, and centering for listed and non-listed members only after the concrete has attained the minimum specified strength and at least one of the following criteria has been met:

3.7.3.1 The Project Manager has approved calculations showing the anticipated concrete strengths at the time of the proposed early removal based on:

a) Ratio of dead load over live load;
b) Span, height and shape;
c) Ratio of rise over span;
d) Shoring;
e) Loads, resultant stresses, and deformations to which the concrete and reinforcing steel will be subject at the time of removal, subsequent to the removal and until the concrete has attained its design strength;
f) Prevailing site conditions.

3.7.3.2 The concrete strength attained prior to form removal has been determined from tests of cylinders cured adjacent to and under the same conditions as the placed concrete.

3.7.3.3 Three test cylinders taken by the test laboratory have been tested by an independent testing laboratory retained by the Contractor and approved by the Project Manager and the tests performed in accordance with Specification 033000.

3.7.3.4 Do not alter the loading conditions on the concrete subsequent to the removal of the forms if it results in exceeding the permissible stresses and deformation at the attained concrete strengths.