

SECTION 033300 ARCHITECTURAL CAST-IN PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the architectural cast-in-place concrete as shown on the drawings and/or as specified herein.

1.3 RELATED SECTIONS

- A. Cast-in-Place Concrete - Section 033000.

1.4 STANDARDS

- A. In addition to requirements shown or specified herein and under Structural Concrete Section, comply with the recommendations of Chapter 11, Formwork Architectural Concrete, and Special Publication No. 4, Formwork for Concrete and ACI 303.1 "Standard Specification for Cast In Place Architectural Concrete," as published by ACI.

1.5 SUBMITTALS

- A. Samples - Submit

1. Cement; 3 to 6 oz. sample of cement submitted prior to design mixes and submitted for each delivery of each cement type to the batch plant during construction. Sample shall be labeled as to date, truck number, mill, lot number and bin number to which delivered.
2. Fine aggregate; each type, 1 lb.
3. Coarse aggregate; each type, 1 lb.
4. Form contact materials; each type, 12" square with flange.
5. Form gaskets; each type, 12" long.
6. Forms for reveals and rustication; each type, 12" long.
7. Reinforcement supports, chairs, tie wire; each type.
8. Form ties; each type.
9. 12' x 12' x 2-1/2" thick samples with finish and treatment required for each type of cast-in-place concrete work using a mix of the required ingredients, strength and color matching the designated color sample. Concrete samples are to be cast vertical against the same form material to be used in the construction. Resubmit samples until approved by the Architect. Samples shall include the following finishes:
 - a. Off the form.
 - b. Light blast.
 - c. Heavy blast.
 - d. Acid etched.
 - e. Water washed.

10. Full size mock-up panels.

- B. Shop Drawings: Prepare shop drawings for approval, including plans, elevations, sections, details and schedules as required to fully illustrate the work, including the Mock-up, and to meet project conditions. Shop drawings shall include but not be limited to the following:

1. Formwork
 - a. Submit detailed drawings showing the location of each panel including shop fabricated joints, field splice joints, tie locations, embedment locations, and clean-out openings. Specifically show details of bulkheads, reveals, recesses and corner assemblies and the means to be used to seal all joints and to maintain alignment.
 - b. Shop drawings shall have the stamp of a Professional Engineer registered in the State of New Jersey.
2. Reinforcing Steel: As per Section 033000.
 - a. Indicate cover, placing passages, accessories and any special detailing.
3. Placing: Submit deposit sequence within each placement, including equipment and projected time between placements.

1.6 MOCK-UP

- A. Do not proceed with construction of the mock-up until all other samples are approved by the Architect.
- B. Mock-up shall consist of a separate 4' high x 4' wide x 1'-6" thick panel constructed on the job site. It is the intent of this specification that the mock-ups serve as the ultimate basis for final in-place work. As such, all shop drawings, details, techniques, materials, formwork, and crews and foremen used to achieve the final approved mock-ups must also be utilized for further in-place work.
- C. Coordinate with other trades performing work on the mock-up.
- D. Prior to placing architectural concrete erect the mock-up at the job site, where directed, consisting of the elements indicated and conforming with the building details. Provide footings and bracing as required or needed to assure continuous stability of the mock- up.
- E. Install, patch, and finish concrete as specified for permanent work. Ensure that all agents and admixtures used in forming and pouring concrete can be cleaned from the work without staining, spotting, etc. Mock-up, when approved by the Architect, shall serve as the approved sample for architectural concrete work as to color, texture, patching and appearance.
- F. If mock-up is not approved by Architect, remove and replace with others at no additional cost to the Owner.
- G. Protect and maintain approved mock-up throughout construction period and remove only when directed by the Architect.

1.7 CONSTRUCTION CONFERENCE

- A. Within thirty (30) days following Notice to Proceed, the Contractor shall schedule a meeting at a mutually agreeable time to include the Architect, the Project Manager, the Concrete Supplier

and the Formwork Manufacturer to discuss materials, methods of work and forming systems for architectural concrete work.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement and Aggregates: Supply cement and aggregates from one domestic raw material and manufacturing source. Do not change source or type of cement or aggregate without Architect's written approval.
 - 1. Portland Cement: ASTM C-150 White.
 - 2. Fine Aggregate: ASTM C-33, clean natural sand and shall be consistent in color and gradation in screens finer than #16.
 - 3. Coarse Aggregate: ASTM C-33, clean crushed stone, free of material finer than #165 screen.
- B. Admixtures
 - 1. Air Entraining: Conform to ASTM C 260 and shall be compatible with other ingredients.
 - 2. High Range Water Reduction (Plant batched superplasticizer): ASTM C-404, Type F or G Containing no chlorides. HRWR shall be Rheobuild 716 by Masterbuilders or Daracem by W.R. Grace.
 - 3. Other Admixtures: Do not use unless submitted for review and acceptance. Admixtures shall be certified in writing by the manufacturer to be in compliance with ASTM C-494.
 - 4. Color Admixtures: "Cromix" by L.M. Scofield Co. or equal by Davis Colors; color as selected by the Architect.
- C. Water: Conform to ACI 301, Chapter 2, Paragraph 203.

2.2 FORMWORK MATERIALS

- A. Formliner: Symmons ABS formliner, "Random Width Cedar Planks", Product Code F70632, 0.110 thick, 4-3/16" x 10'. (Wherever poured concrete walls have exposed finish).
- B. Smooth Surfaces: Flat wall surfaces shall be formed with plastic impregnated (min. 165 gr.), multi-layer (min. 14 plys/in), birch plywood, 3/4" thick. Panels shall be Finn- Form (Red) as distributed by Plywood and Door Corp., Union, NJ.
- C. Form Gaskets (for sealing form panel joints): Gaskets shall be closed cell, foam rubber or neoprene, with pressure sensitive paperbacked adhesive on surfaces to be bonded to forms. Gaskets shall be of sufficient thickness, widths, and compressibility for specific use.
- D. Gasket adhesive remover shall not discolor concrete and thoroughly remove any adhered adhesive. Approved remover: Asphalt and tar remover #509 by ProSoCo, Kansas City, KS.
- E. Reveal Formers and Reformers: Resilient elastomeric with a wood core as manufactured by Scott Systems Inc., Denver, CO.
- F. Form Release Coating: Colorless, non-staining and having no deleterious effect on the concrete. Coating shall be Crete-Lease 727 or 880 by Cresset Chem Co. Weston, OH.

- G. Form Ties: Ties shall be tapered stud She-Bolts, He-Bolts or Through-the-wall tapered ties. Ties shall leave a hole of not more than 9/16" in dia. on the concrete surface, and no metal closer than 1" from the surface. Ties shall be used with external spreading devices. Use stainless steel leave in material. Ties shall be:
1. She-Bolt by Williams Form Engineering, Grand Rapids, MI.
 2. He-Bolt by Dayton/Superior Co., Folcroft, PA.
 3. Through-Taper by Gates & Sons, Denver, CO.
- H. Reinforcing: Provide as specified in other Concrete Sections except as hereafter modified:
1. All spacing and support devices shall be high density plastic or steel wire with plastic coated feet (Dipped type). Color of the plastic shall match the concrete color.
 2. Tie Wire: Tie wire at exposed surfaces or for all work above an exposed soffit or ceiling shall be non-corrosive, plastic-coated wire.

2.3 MISCELLANEOUS MATERIALS

- A. Waterproofing Sealer: "Lithofin PSI Premium Silicone Impregnator" by VIC International Corporation. Note: Sealer must be compatible with all other sealants it comes in contact with (i.e. expansion joints, sealants or window etc.).
- B. Sealant: Sealant for concrete to concrete in revealed expansion, construction and control joints shall be as specified in Section 079200.
- C. Concrete Etching Solution: Shall be commercial concrete cleaner containing solvents, chloride acid, and stain removers. Accepted cleaner: Limestone Cleaner by ProSoCo, Kansas City, KS.
- D. Curing Materials: Curing compound shall conform to ASTM C309, and shall be colorless. Compound shall be CUR-TO-SPEC-MS by ProSoCo, Kansas City, KS.
- E. Any other miscellaneous materials required, but not specified herein, shall conform to the requirements of Section 033000.

2.4 MIXES

- A. General: Comply with Section 033000 except that slump shall be 4" plus or minus 1/2".
- B. All architectural concrete shall have water reducing agent.
- C. Mix shall be designed with low water content (max. 2"). Fluidity shall be attained with addition of high range water reducing agent to a slump of 6" + 1" (including high range water reducing agent in color admixture).

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions where architectural cast-in-place concrete is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 FORMWORK

- A. Comply with Section 033000 except as hereinafter specified.
 - 1. Formwork foreman shall be experienced in architectural concrete formwork. Submit qualifications of foreman for approval.
 - 2. Design forms to permit easy removal. Prying against the face of concrete will not be allowed.
 - 3. The forms shall be completely rigid and strong enough to withstand without deflection, movement, or leakage, the full liquid head, and the high hydraulic pressures which result from rapid filling and high-frequency vibration.
 - 4. Use screw-type fastening devices to align and close joints at contact face. Yoke beams and columns where possible with threaded rods and use diagonal rods to hold horizontal wales at corners. Install rods so that the tightening action acts to close form joints.
 - 5. Form Panel Joints: All joints in formwork, wherever located, shall be sealed to remain watertight. Seal as follows:
 - a. Caulked: Butt board ends and plywood edges sealed on contact surfaces.
 - b. Gasketed: Joints erected and stripped in field. Form to form or form to concrete.
- B. Reveal Formers and Reformers: Fabricate and fasten to avoid protruding splinters which may become embedded in the concrete. Fasten to hold alignment during placing.
- C. Construction Joints: Joints shall be made only at revealed form joint locations shown on the architectural drawings. Spacing between construction joints shall be determined by the following:
 - 1. Maximum Area of Wall Placement: 300 sq. ft.
 - 2. Maximum Dimension: 15 ft.
 - 3. The formwork for second placements of construction joints shall be gasketed and held tight to the in-place concrete to prevent fluid loss.
- D. Plastic Surfaced Plywood: See architectural drawings for pattern of joints. Back fasten all contact material to supports. Penetrating the face is not permitted. Drill tie holes from contact face using brad point bits. All tie holes and cut edges shall be sealed as directed by the manufacturer.
- E. Form Ties: Locate as detailed on drawings symmetrically in level horizontal rows and plumbed vertically. Ties shown may be used as dummy ties or working ties. Tie cones shall be drawn tight against the contact face. Reusable portions of form ties shall be maintained free of rust and damage.
- F. Reuse of Forms: Forms may be reused only when properly maintained and in a satisfactory condition and approved by Architect. Forms which cannot be tightly butted and made watertight shall not be reused. If reuse of forms is approved by Architect, clean forms, and repair damaged surfaces.
- G. Cleaning and Coating of Forms: Clean all form contact faces uniformly and coat with coat of specified form release coating per manufacturer's written instructions. Remove excess form coating and do not allow coating to come in contact with previously placed concrete against which fresh concrete will be placed.

- H. Water Stops: Strip shall be applied to primed concrete surface as directed by the manufacturer. Strip shall be positioned at edge of joint adjacent to earth for sub-grade installation and inboard of the exterior layer of reinforcing steel for above-grade installations.

3.3 FORMWORK TOLERANCES

- A. Hydraulic Pressure: Design Forms, studs and walers to limit deflections between supports and stiffening members to $L/400$ of the span.
- B. Finish Lines: Position formwork to maintain hardened concrete finish lines within the following permissible deviations.
 - 1. Variations from Plumb in 10 Feet: $+1/8"$.
 - 2. Cross-Sectional Dimensions: Minus $1/8"$, plus $1/4"$.
 - 3. Surface Tolerances: Maximum offset between butt joints of individual or ganged forms - $1/32"$.
 - 4. Line of Troweled Edge at Top of Spandrel in 10 Feet: $+1/8"$.

3.4 REINFORCEMENT

- A. General: Comply with Concrete Section 033000, except as hereinafter modified:
 - 1. Concrete coverage over reinforcing steel, including bands shall be no less than 2 in. for architectural concrete surfaces, including beam bottoms. The Contractor shall notify the reinforcing steel fabricator that strict compliance to coverage requirements and bent bar details is extremely important.
 - 2. Tie wires shall be cut as closely as possible to the bars and bent behind the bars in such a manner that concrete placement will not force the wire ends to the exposed concrete surfaces.
 - 3. Provide an unobstructed passage, min. 10" long, between the layers of reinforcing steel for placement of tremmies and trunks in placing the concrete. Passage shall be a maximum of 8'-0" apart, 4'-0" from each corner.

3.5 PLACING CONCRETE

- A. Coordination: The Batch plant, transit, conveying and placing operations shall be coordinated so that all concrete is in its final position within 1-1/2 hrs. (1 hr. when temperature is above 90 deg. F.) from the time the mix is charged with water. This coordination shall be performed so that any deposit load placed in the forms shall be covered by a subsequent deposit within 15 minutes and in a continuous manner. Truck delivery, truck changing, crane positions, bucket size, tremmie numbers and location, lift heights, etc. shall be planned and directed toward achieving homogeneous and consistent placements.
- B. General: Place concrete in accordance with Section 033000 except as hereinafter modified:
 - 1. Clean truck mixer drums thoroughly prior to batching. Load truck mixers at the volume which will ensure a uniform batch at the slump specified. In the event that mixing is not uniform, the truck may either be rejected and not used on the project, or if warranted, allowed to mix only batches which will assure delivery of a uniform concrete of the specified slump.
 - 2. Handle concrete from the mixer to the place of final deposit as rapidly as practical by methods which prevent separation or loss of the ingredients.

3. Clean transporting and handling equipment at frequent intervals and flush thoroughly with water before and after each day's run.
- C. Retempering: Do not place concrete in forms after it has taken initial set. Retempering of concrete which has partially set is prohibited.
- D. Clean Formwork: Formwork shall be clean and free from papers, sawdust, dirt and debris immediately prior to and during the time concrete is placed thereon. Spaces shall be thoroughly cleaned prior to closing formwork and maintained clean until concrete is placed. Formwork which will be in place and closed while other work is being carried out which could impair its cleanliness shall be provided with clean-out panels in surfaces not exposed to view, or with panels following approved joint lines; panels shall be noted on shop drawings. Just prior to placing concrete thoroughly inspect the interior of formwork and clean out all debris with vacuum cleaners, magnets, air or water jets as required.
- E. Vibration: Concrete shall be compacted thoroughly by vibrating using internal vibrators only to produce a dense, homogeneous mass without voids or pockets. Vibrators shall be placed in the concrete vertically and thoroughly blend adjacent deposits and layers. After top out leveling of all exposed spandrels the concrete shall be allowed to set 10 to 20 minutes then shall be given a final vibration, drawing the head out slowly to remove entrapped air. Immediately thereafter surface shall be hard troweled.
- F. All vibrating operations shall be performed by the same skilled person responsible for vibrating acceptable concrete in the mock-ups.

3.6 CURING AND PROTECTION

- A. Hot Weather Protection: Shall be in accordance with Section 033000.
- B. Curing: Apply curing compound immediately after form removal in accordance with manufacturer's recommendations for maximum moisture retention and colorless application.
- C. Protect all horizontal and vertical corners of concrete for full length or full height of exposed corner with continuous wood corner guards. In areas where high activity warrants, protect all vulnerable surfaces.

3.7 FORMED CONCRETE FINISHES AND TREATMENTS

- A. Finish and Treatment of Formed Concrete Surfaces: Architectural concrete formed surfaces shall have "as-cast" finish, using forms specified and where indicated on drawings. Concrete surfaces shall also receive the following treatment as indicated below:
 1. Dressing, patching, texturing by etch cleaning, light and heavy blasting, and water washing, and the application of a water repellent.
- B. Final Finish Types: Apply the following finish types as required below:
 1. Dressing: Shall mean removal of all runs, splatters, fins, projections, and stains, in a manner which avoids scarring, staining or scratching the surface.
 2. Patching
 - a. Exposed Concrete: It is the intent of these specifications that the concrete work will be performed in a manner that no patching of exposed concrete will be

required. In the event remedial action is accepted as a means of rendering work acceptable it shall consist of patching with a texture-matched technique and color matched mortar. Only areas designated by Architect will be patched. Patching shall be done after the application of texture treatment and before the water repellent application.

3. Texturing of Concrete: All exposed surfaces shall receive the following treatment:
 - a. Light abrasive blast finish to match approved samples and mock-up.
 - b. All concrete to be treated shall be a minimum of twenty-one (21) days old.
 - c. Thoroughly clean work areas of waste material as soon as each segment of work is completed and protect work which may be damaged by this operation in an accepted manner. Be responsible for fallout and for protecting persons, adjacent work and property. Comply with requirements of the Building Code and all agencies having jurisdiction.
 - d. Etch Cleaning
 - 1) Apply cleaner in an even manner break to break and joint to joint of surface, allow to set and flush in a consistent manner throughout project. Proceed in a manner approved by the product manufacturer.
 - 2) Treatment shall produce a "matte" surface by just removing the surface of the cement skin. Treatment shall not expose aggregate larger than that passing #20 screen.
 - e. Tie Holes: Tie holes requiring plugging will be plugged with concrete. Spalled or defective tie holes may be required to be patched with approved patching mortar, but only patch if required by Architect.
4. Corners, whether horizontal or vertical, shall not be chamfered.
5. Apply clear repellent "Lithofin PSI" by Vic International, to wall surfaces in one application following manufactures instructions.

END OF SECTION 033300