



SECTION 03300
CAST-IN-PLACE CONCRETE

JUN 19 2012

PART 1 - GENERAL

1.01 DESCRIPTION

- A. All poured-in-place structural concrete including but not necessarily limited to concrete footings, foundations, beams, columns, steps, slabs, floor toppings, etc.
- B. Reinforcing steel and accessories.
- C. Form Work.
- D. Setting of all anchors, bolts, hangers and sleeves.
- E. Related Work Specified Elsewhere:
 - 1. Structural Excavation, Backfill & Compaction: Section 02222
 - 2. Paving and Surfacing: Section 02600
 - 3. Site Drainage: Section 02500
 - 4. Grout: Section 03600
 - 5. General Provisions, Mechanical: Section 15010
 - 6. General Provisions, Electrical: Section 16010

1.02 QUALITY ASSURANCE

- A. The American Concrete Institute Field Reference Manual, Publication SP-15, "Specifications for Structural Concrete for Buildings, ACI 301-89, with selected ACI and ASTM references," and ACI Standard 318-92, "Building Code Requirements for Reinforced Concrete" are hereby included in and made a part of these specifications. A copy of these manuals shall be kept in the project field office at all times and made available to all personnel involved in supervising, inspecting or testing of concrete work.

1.03 SUBMITTALS

- A. Submit sufficient shop drawings for reinforcing steel, formwork and concrete mixes to Architect for review. Submit drawings in accordance with General Conditions & Supplementary General Conditions. Obtain acceptance of drawings prior to fabrication of any material or proceeding with the work. Shop drawings for reinforcing steel shall indicate bending diagrams; assembly diagrams, splicing and laps of bars, shapes, dimensions and details on bar reinforcing and accessories. Drawings shall be prepared in accordance with the "Manual of Standard Practice for

Detailing Reinforced Concrete Structures", ACI-315. Scale dimensions from structural drawing shall not be used in determining the lengths of reinforcing rods. Complete placement plans and details shall be included.

- B. The Contractor is responsible for all dimensions of the concrete work and shall check the structural drawings in relation to all other drawings and shall verify all dimensions in relation with other work and field conditions. Contractor is responsible for proper arrangement and fit of the work and if discrepancies are noted between the various drawings and work, the Contractor shall notify the Architect immediately in writing and shall not proceed until so directed.
- C. The omission from shop drawings of any materials shown on the original structural drawings or called for by these specifications shall not re-lieve the Contractor of the responsibility for furnishing and installing such materials, even though such shop drawings may have been returned without comment.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type 1, (domestic manufacture).
- B. Sand: Clean, hard and natural sand, or manufactured sand, or a combination of both and conforming to ASTM C33, except grading requirements shall be in accordance with K.D.O.T. 902. A sand with fineness modulus not less than 2.1 nor more than 250 PPM Tanic Acid shall be used.
- C. Coarse aggregate shall be hard, durable, uncoated crushed stone or gravel conforming to ASTM C-33 and shall be non-reactive. Maximum size of aggregate shall not exceed 1" for mass concrete, 3/4" for beams and slabs, and 3/8" to 1/2" for thin sections or confined areas.
- D. Water: Clean, fresh, potable, free from injurious amounts of vegetable matter, alkalies and other impurities.
- E. Water Reducing Admixture: Conforming to ASTM C494, Type A or D such as WRDA, Pozzolith.
- F. Water Reducing and Accelerating Admixture; Conforming to ASTM C494, type E such as WRDA, Pozolith.
- G. Air Entraining Admixture: Conforming to ASTM C260, such as Darex or M.B.V.R.

- H. Fly ash and pozzolans: Conforming to ASTM C618, class F.
- I. Reinforcement:
1. Reinforcing bars: Bars shall be deformed billet steel conforming to ASTM A615 , Grade 60 or 40 as called for on the drawings. Reinforcement shall be clean and free from loose rust, scale or other coatings that will reduce bond.
 2. Welded Wire Fabric Reinforcing: (ASTM A185)
Steel wire spot welded at intersections and of size indicated. Where size is not noted, it shall be 6"x6" mesh, No. 10 gauge (W1.4).
- J. Metal Accessories: Include all spacers, chairs, bolsters, ties, and other devices necessary for properly placing, spacing, supporting and fastening reinforcing in place. Metal accessories shall have plastic tips where legs will be exposed in finished concrete surfaces. Accessories shall conform to requirements of the Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice". Chairs and other accessories fabricated from concrete, ceramic or plastic may be used in place of metal accessories with approval by the Architect.
- K. Expansion Joint Filler: Asphalt impregnated fiberboard conforming to ASTM D-1751-78 and extending full depth of slab or joint.
- L. Isolation Joint Fillers: Isolation joint fillers shall consist of 1/8 inch wide strips of Neoprene, synthetic rubber or 90 pounds roofing felt and extending full depth of slab.
- M. Grout: Non metallic, non-shrink grout meeting ASTM C1107:- Vibropruf #11 by Lambert Corp or "Masterflow" by BASF.
- N. Curing Compounds: Water-based Glazecoat 20 or solvent- based Crystal Clear Seal 1315 by Lambert Corp.
- O. Concrete Sealer/Dustproofer: Second application of curing compounds specified above shall qualify as surface hardeners for exposed floor areas.
- P. Vapor Barrier: Polyethylene plastic sheet having a minimum thickness of 6 mils.

2.02 MIXES

- A. All concrete, unless otherwise specified, shall be controlled concrete and shall be proportioned as outlined in Section 4.3 of the Building Code of the American Concrete Institute (ACI 318-92). The allowable design stresses are based upon the minimum 28-day compressive strength called for on the

structural drawings.

B. All concrete mixtures proportioned on the basis of trial batches shall be designed by an independent laboratory approved by the Architect and paid by the Contractor.

C. Proportions:

1. Proportions of materials shall be selected to provide a plastic, work-able mix. Where early removal of forms is a consideration, concrete strength shall attain 75% of the specified 28-day compressive strength within the allotted time interval prior to stripping.

2. Water shall be accurately, uniformly measured into mix by water measuring device. Aggregates shall be periodically tested for water content and added mixing water adjusted accordingly without changing the water-cement ratio established for the job.

3. All measurement of materials shall be done by weight with allowance made for moisture content of aggregates. Admixtures shall be dispensed by automatic, metered devices with at least plus or minus 5% accuracy. These dispensers shall be regularly inspected and certified as to accuracy by the manufacturer of the admixture.

4. Concrete supplier shall submit to the Architect (through the General Contractor) for approval, complete design data, mix quantities, properties of aggregates and laboratory strength test reports for each proposed concrete mix in accordance with ASTM C-94. Mix and all tests shall have been made at no additional cost to the Owner.

D. Admixtures:

1. Use Type "A" (normal) admixture for all structural concrete except when air temperature exceeds 90 degrees F, use Type "D" (retarder) admixture.

2. Type "E" (accelerator) admixture shall be used only when air temperature drops below 50 degrees F, but shall not be used in prestressed concrete or concrete placed on galvanized metal deck or concrete containing embedded items of aluminum or galvanized steel.

3. An approved air entraining admixture shall be added to the concrete mix in the amount and manner recommended by the manufacturer in order to obtain an air content of 3.0 percent, plus or minus 1.5% of the volume of the concrete for normal weight concrete and 5.0 percent plus or minus 1.5% for Lightweight concrete. Air entraining agent must be compatible with other additives. Do not pre-mix with other liquid admixtures. Add air entraining admixture to mix water, add other admixtures to the sand. Be sure each liquid admixture is Added separately from separate dispensers.

4. Fly ash shall not be used without prior approval by the architect and if approved shall in general not exceed a 1 to 3 cement ratio by weight.

PART 3 - EXECUTION

3.01 FORMS

- A. All forms shall conform to the lines, dimensions and shapes of the concrete as indicated on the drawings. They shall be watertight to prevent leakage of mortar and shall be smooth except where otherwise required, and free from defects where the concrete is to be left exposed. The forms shall be in such condition and have ample supports so that they will not bulge or get out of line or level as concrete is placed. For exposed work, the maximum tolerance in line and level will be 1/16" at the joints. It will be the concrete contractor's responsibility to see that forms are supported well enough to insure the safety of workmen and the public, regardless of any review by Architect. Design of formwork shall comply with ACI 347.
- B. Formwork and shoring plans prepared by the contractor and certified by a licensed professional engineer shall be submitted to the architect for review.
- C. Proper shoring shall be provided under the forms for concrete work to support the weight of forms, concrete and construction live loads. Each post shall be secured against horizontal movement by bracing or other means at the bottom and top. Diagonal bracing shall be included at each post and at additional points as required.
- D. Unless otherwise noted, forms shall not be stripped until concrete has attained 75% of the specified 28-day compressive strength as determined by field cured molded concrete test cylinders.
- E. Camber bottom of slab and beam forms as required to maintain surface tolerances as specified hereinafter.
- F. Exposed corners of all concrete surfaces shall have 3/4" chamfer unless otherwise noted.
- G. The inside surface of wood board forms shall be soaked with clean water prior to placing concrete. Plywood shall be treated with an approved form oil or lacquer. If oil is used, all excess oil shall be wiped off with rags to leave the surface of the forms just oily to the touch. Where plaster bond finish is required, forms shall not be oiled. Forms shall not be oiled after reinforcing is in place. Form

oil on reinforcing will not be permitted.

- H. All keys shall be securely held in position by continuous wood blocking rigidly secured to forms or reinforcing.
- I. Re-usable forms shall be maintained properly by cleaning and repairing after each use as required to insure satisfactory finished concrete work.
- J. Provide temporary clean out openings at the base of all forms and other points where necessary to facilitate cleaning and inspection for placing concrete. Each column shall include such an opening.
- K. Form ties used for exposed concrete surfaces shall be of type approved by the Architect. They shall have minimum working strength when fully assembled of at least 3000 lbs. Wire ties will not be permitted.
- L. Ties that are apt to be pulled from the walls, shall be coated with cup grease or other approved material to facilitate removal.
- M. Tie rods that are to be entirely removed from the walls shall be loosened 24 hours after the concrete is poured. All but a sufficient number of ties to hold the forms in place may be removed at that time.

3.02 PREPARATION

- A. All concrete slabs on ground including haunched areas shall be placed on compacted clean sand subgrade. Cover subgrade with Vapor barrier in wide rolls with joints lapped. All backfill shall be machine tamped in 8 inch layers.
- B. Ready-Mix Concrete: Ready mixed concrete shall be mixed and delivered to the project in accordance with ASTM Specification C94.
- C. No water shall be added to mixer after leaving ready mix plant without approval of the concrete supplier.
- D. Before placing concrete, all debris, water and ice shall be removed from the places to be occupied by the concrete. Wood forms shall be thoroughly wetted or oiled, and the reinforcement cleaned.
- E. Screeds: All screeds shall be set with a level and not by measuring above preset forms. Check architectural drawings for areas to be recessed. All slabs to be drained shall slope to floor drains set a minimum of one (1) inch below finish line. Full slab thickness shall be maintained. Set

screeds at center of span of supported slabs and beams to provide camber to offset anticipated dead load deflection.

3.03 INSTALLATION

- A. Placing of reinforcement shall comply with the Concrete Reinforcing Steel Institute's Manual for Recommended Practice for Placing Reinforcing Bars, 2nd Edition, ACI Manual 301-89 and ACI Code Requirements 318-92.
- B. Place reinforcement accurately in position shown, securely fasten and support to prevent displacement before or during pouring. Bending, placing and splicing of reinforcement shall be in accordance with approved shop drawings. Mesh reinforcement in slabs shall have sides and ends lapped not less than one mesh.
- C. Provide for installation of inserts, conduit, pipe sleeves, drains, hangers, metal ties, shelf angle supports, anchors, bolts, angle guards, stair nosings, dowels, thimbles, anchor slots, metal reglets, nailing strips, blocking grounds and other fastening devices required for attachment of other work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Where openings are left in concrete for the passage of ducts, the openings shall be made slightly larger than the duct size. Where boxes are required for floor type closers, they shall be accurately located. Do not install sleeves in any concrete beam, joist or column except after approval of Architect/Engineer.
- D. Anchor slots in concrete for securing masonry facing and masonry walls and partitions to concrete shall be provided and installed under this section. Seal face of slot with tape or pack with felt strips to prevent entrance of cement or grout. Set anchor slots straight at proper location and securely fasten to forms to prevent displacement while concrete is being poured. The anchors for inserting in slots are included under other sections.
- E. Metal flashing reglets set in concrete forms to receive metal flashing shall be provided by roofing and sheet metal contractor and set by General Contractor.
- F. All sleeves, chases, inserts, hangers, etc., which are provided and placed in the forms by the various trades, shall be maintained in position and protected until the concreting is completed. (Hangers where required, shall be anchored to the main reinforcing bars).
- G. Concrete shall be rapidly handled from mixer to forms and deposited as nearly as possible in its final position to

avoid segregation due to re-handling or flowing. Placement of concrete shall follow ACI 301-89 and ACI 304-89 recommendations.

- H. Truck mixing shall be delayed until only time remains to accomplish mixing before placing. During extremely hot weather, avoid unnecessary exposure of mixers to sun while waiting. Dispatching of trucks and organization of use of concrete shall be coordinated to avoid unnecessary mixing of concrete. Provide sufficient personnel to handle work properly to avoid temptation to add water for handling. Maximum time from introduction of mixing water to discharge shall not exceed 90 minutes; reject all concrete in truck over 90 minutes.
- I. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited in the work.
- J. All concrete shall be placed upon clean, well-thawed, damp surfaces, free from water.
- K. Concrete shall not be allowed to drop freely more than three (3) feet. Where greater drops are required, a tremie or other method approved by the Architect/Engineer shall be employed.
- L. Concrete shall be mixed and placed only when the temperature is at least 40 degrees F and rising. Refer to ACI 305R-91 and ACI 306R-88, respectively, for additional recommendations for hot and cold weather concreting.
- M. Minimum practicable slump shall be used for all reinforced concrete work. Water-cement ratio shall not be altered from design standards under any circumstances unless specifically approved by the Architect.

3.04 FIELD QUALITY CONTROL

- A. Testing laboratory shall be notified by the Contractor not less than 24 hours before concrete is being placed and field testing and test cylinders are to be obtained.
- B. Testing lab personnel shall take samples and make tests as hereinafter listed for each 50 cubic yards of fresh concrete or fraction thereof in the project, but not less than one set for each day's concreting. He shall properly mark and identify each test cylinder, store and protect same until they can be delivered to the testing laboratory, and keep an adequate log record of all cylinders and other tests made, including areas or locations where concrete was placed for which tests or samples were taken.

- C. Compression Strength Tests: Each test shall consist of four standard 6"x12" cylinders; one cylinder to be tested at the age of seven (7) days and two (2) cylinders at the age of twenty-eight (28) days. The fourth cylinder shall be retained for further testing, if necessary. Samples from which compression test specimens are molded shall be secured in accordance with the ASTM C172. Strength tests shall be made in accordance with ASTM C39. Additional samples and tests required by the contractor for purposes of stripping forms shall be performed by the testing laboratory at the expense of the contractor.
- D. Slump Tests: Tests for slump shall be made at the place of deposit and in accordance with ASTM C143. Tests shall be made for each 50 cubic yards of concrete poured or more frequently where variations in slump appear evident. Concrete with slump over six (6) inches shall be rejected and not placed. Water may be added, at the rate of one gallon per yard, to increase the slump by approximately one (1) inch to improve workability where desired, up to a maximum slump of five (5) inches (4 inches for slab on grade). Concrete Supplier's approval is required.
- E. Enforcement of Strength Requirements:
1. Acceptability of concrete shall be in accordance with ACI 318-92. When the ultimate compressive strength of any cylinder falls below the specified strength for the class of concrete specified, the design mix and water content shall be adjusted to produce the specified strength for concrete that is subsequently placed. In addition, the Architect may order additional curing for the portion of the structure where questionable concrete has been placed. In the event that such additional curing does not give the strength required, as determined by load tests made in accordance with ACI 318-92, or cored cylinder tests, and if such tests indicate the necessity, the defective parts shall be removed and replaced or shall be reinforced as directed by the Architect, at the Contractor's expense, including the expense of the tests.
 2. Four (4) copies of laboratory test reports shall be sent directly to the Architect, and two (2) to the General Contractor by the laboratory.

3.05 FINISHES OTHER THAN FOR FLOORS

- A. All exposed interior and exterior walls, curbs, ceilings and other concrete surfaces except as otherwise specified or called for in the Finish Schedule shall after removal of forms have all fins and form marks removed by grinding, voids and honeycombs filled and shall be rubbed with carborundum as required where a smooth finish is indicated.

- B. In all foundation walls below grade and pit walls on backfill side as well as exposed side, the ties and spreaders shall be cut back to a depth of approximately 1 1/2". Any cuts shall be to a depth of at least 1 1/2" with the edges perpendicular to the surface.
- C. Concrete surfaces not exposed to view may be left as they come from the forms. All holes resulting from cutting back for scale pockets, honeycomb, surface voids and the removal of form wires or spreaders shall however, be filled with cement mortar.
- D. Patching
 - 1. Any concrete which is not formed as shown on the drawings or for any reason is not of alignment or levels or shows a defective surface shall be considered as not conforming with the intent of these specifications and shall be removed from the job by the Contractor at his expense unless the Architect grants permission to patch the defective area. Permission to patch any such area shall not be considered a waiver of the Architect's right to require complete removal of the defective work if the patching does not in his opinion satisfactorily restore the quality and appearance of the surface.
- E. Plaster Bond Finish: Plaster bond finish shall be used for all concrete surfaces that are to receive mortar, plaster or stucco applied directly thereto after forms are removed. Clean concrete surfaces of oil, grease, dirt and loose particles. Application of bond coats shall be included under another section of these specifications. A chemical bonding agent shall be used on all concrete receiving a bonded finish.

3.06 FLOOR AND SLAB FINISHES

A. General

- 1. The finish of all floors and slabs shall be as indicated on the drawings or as herein stipulated or as is obviously suitable for the specific floor or slab. Hereinafter listed are descriptions of common types of finish. Finished concrete slabs shall be worked so that large aggregate will not be visible in the top surface.
- 2. All floors must be protected during construction to prevent marring and defacement.
- 3. Where the allowable tolerances in surface elevation of slabs are exceeded, the Architect may direct the

Contractor to grind or patch the floor to bring the surface within the requirements. Grinding shall be done as soon as possible but not before three (3) days of cure. All grinding shall be done at Contractor's expense.

4. Broom or belt finish. Sidewalk slabs in other Locations so specified, shall be given a medium transverse scored texture by drawing a broom or burlap belt across the surface. This operation shall follow immediately after floating. Floating shall be performed as outlined above.

3.07 CURING AND PROTECTION

A. Curing

1. The top surface of all slabs shall be sprayed with an approved liquid membrane-forming compound in accordance with the directions of the manufacturer as soon as the newly placed surface has been finished and will not be marred by application.

2. The liquid membrane-forming compound shall meet the requirements of "Specifications for Liquid Membrane-Forming Compounds for Curing Concrete" (ASTM C-309), and shall contain a fugitive dye.

3. The Contractor shall submit to the Architect test reports from an independent testing laboratory or other acceptable data, including a manufacturer's guarantee, proving compatibility with all types of resilient floor adhesives as well as separate cement and terrazzo toppings.

4. Surfaces subject to heavy rainfall within three (3) hours of compound application shall be resprayed.

5. At all exposed interior concrete slab surfaces, the liquid membrane-forming compound used shall also have an approved rating as a surface hardener. Additional coats shall be applied in strict accordance with the manufacturers printed instructions.

6. Where practicable, forms shall be kept in place for a 7-day curing period or until concrete has attained 75 percent of their specified design strength.

B. Protection

1. Protect concrete from construction traffic, including action of sun, rain, flowing water, frost, or mechanical injury for a period of two (2) weeks after placing. Traffic areas shall be provided with raised runways.

3.08 TOLERANCES

A. Variation from plumb

1. Columns, piers and walls - 1/4" per 10', but not more than 1".

2. Exposed spandrel columns and other conspicuous lines
- 1/4" per 20', but not more 1/2".

B. Variation from level or established grade

1. Slab soffits, ceilings, beam soffits-
1/8" per 10', but not more than 1/4" per bay
or 20' max.

2. Exposed lintels, sills, parapets, horizontal
grooves, or other conspicuous lines- 1/4" per bay or
20' max.

C. Variation in surface tolerance

1. 1/8" per 10' in any direction. Deflection
of form facing material between supports shall not
exceed $0.0025 \times \text{span}$.

D. Variation in steps

1. Consecutive steps- 1/16" per riser, 1/8" per tread.
2. flight of stairs- 1/8" in rise, 1/4" in run.

END OF SECTION



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SECTION 03600
GROUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. All grouts and anchoring cements.
- B. Related work specified elsewhere:
 - 1. Cast-in-place Concrete: Section 03300
 - 2. Precast Prestressed Concrete Plank: Section 03420
 - 3. Unit Masonry: Section 04200
 - 4. Structural Steel: Section 05120
 - 5. General provision, Mechanical: Section 15010
 - 6. General Provision, Electrical: Section 16010

1.02 QUALITY ASSURANCE

- A. ASTM C109, C191, and C827

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Non-shrink grout - Halco, by Hallemite or Embecco by Master Builders.
- B. Anchoring cement - Por-Rok by Hallemite

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mix and install in accordance with manufacturer's printed instructions.

END OF SECTION