

## SECTION 03300 - CAST-IN-PLACE CONCRETE

## 1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary conditions and other Division 1 Specification Sections, apply to this Section.

## 1.2 GENERAL

## A. Submittals: Submit the following:

1. Product data for reinforcement, forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds and others as requested by Engineer.
2. Shop drawings for fabricating, bending, and placing concrete reinforcement. Contract Drawings in any form shall not be submitted as shop drawings.
3. Laboratory test reports or evaluation reports for concrete materials and concrete mix designs.
4. Written report to Engineer for each proposed concrete mix at least 15-days prior to start of concreting. Do not begin concrete production until mixes have been reviewed by Engineer.

## B. Quality Assurance: Comply with provisions of ACI 301, "Specifications for Structural Concrete for Buildings," ACI 318, "Building Code Requirements for Reinforced Concrete," and CRSI "Manual of Standard Practice," except where more stringent requirements are indicated.

## 1. Pre-Slab Conference:

- a. At least 30-days prior to commencing floor slab construction, the Contractor shall hold a meeting to review the concrete design mixes and to determine the procedures for producing proper concrete construction.
- b. The Contractor shall require responsible representatives of every party who is concerned with the floor slab concrete work to attend the conference, including but not limited to the following:
  - 1) Contractor's superintendent - Laboratory responsible for the concrete design mix - Laboratory responsible for field quality control - Concrete subcontractor - Ready-mix concrete producer - Admixture manufacturer(s) - Concrete pumping equipment manufacturer, if applicable.
- c. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by him to all parties concerned within five (5)-days of the meeting.
- d. The minutes shall include a statement by the concrete subcontractor, and admixture manufacturer(s) indicating that the proposed mix design and placing can produce the concrete quality required by these specifications.
- e. The Structural Engineer will be present at the conference. The Contractor shall notify the Structural Engineer at least 10-days prior to the scheduled date of the conference.
- f. Refer to Section 01200, "Project Meetings," for any additional requirements.

2. Concrete Testing Service: Engage a testing agency acceptable to Engineer to perform materials evaluation testing and to design concrete mixes.

- a. Materials certificates signed by concrete producer and Contractor may be submitted in lieu of materials laboratory testing when acceptable to Engineer.

### 1.3 PRODUCTS

- A. Form Materials: Furnish form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.
  1. Forms for Exposed Concrete Surfaces: Suitable panel-type material to provide continuous, straight, smooth, exposed surfaces.
  2. Preformed metal keyways shall not be used except as a temporary form.
- B. Reinforcing Materials: As follows:
  1. Deformed Reinforcing Bars: ASTM A 615, Grade 60, minimum laps shall be 30 bar diameters unless otherwise indicated.
  2. Welded Wire Fabric: ASTM A 185.
- C. Concrete Materials: As follows:
  1. Portland Cement: ASTM C 150, Type 1.
  2. Fly Ash: ASTM C 618, Type F.
  3. Aggregates: ASTM C 33, except local aggregates of proven durability may be used when acceptable to Engineer.
    - a. Coarse Aggregate: 3/8-inch in masonry grout, 3/4" in slabs 3 inches or less in thickness, and one (1)-inch elsewhere.
  4. Water: Potable.
  5. Masonry Grout: Shall comply with ASTM C476 for coarse grout.
  6. Non-Shrink Grout: Grout below column bases shall be "Euco NS" by Euclid Chemical Co. or equal by Master Builder, Conspec, or L&M Construction Chemicals.
- D. Admixtures: Provide admixtures that contain not more than 0.1 percent (0.1%) chloride ions.
  1. Air-Entraining Admixture: ASTM C 260.
  2. Water-Reducing, Retarding, and Accelerating Chemical Admixtures: ASTM C 494.
- E. Related Materials: As follows:
  1. Vapor Retarder: Provide 10-mil Stegowrap Class C Vapor Barrier with taped seams (Stego Tape). Contact distributor to obtain National Account pricing (no equals accepted).
  2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq yd when dry.
  3. Moisture Retaining Cover: ASTM C171, polyethylene film or white burlap -polyethylene sheet.
  4. Membrane-Forming Curing Compound: ASTM C 309, Type I. Moisture loss not more than 0.55 kg/sq. meter when applied at 200-square feet/gallon. If a curing compound is used, it shall be certified by the manufacturer to be compatible with any applied adhesives and finishes.

5. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
  6. Joint Sealers: See division 07.
- F. Concrete Sealer: L & M- Dress & Seal WB30 (no equals).
- G. Topping/Leveling Compounds: Cement based patch, topping and leveling compounds for use under hard and soft tile surfaces.
1. For thicknesses up to ½-inch, use Ardex CD.
  2. For thicknesses over ½-inch, use Ardex SD-T. If thickness exceeds 1-½-inch, add aggregate to extend thickness range.
- H. Mix Proportions and Design: Proportion mixes complying with mix design procedures specified in ACI 301.
1. Limit use of fly ash to not exceed 25-percent (25%) of cement content by weight.
  2. Design mixes to provide normal weight concrete with the following properties:
    - a. 3000-psi, 28-day compressive strength; water-cement ratio, 0.60 maximum (non-air-entrained), 0.55 maximum (air-entrained).
    - b. 4000-psi, 28-day compressive strength; water-cement ratio, 0.50 maximum (non-air-entrained), 0.45 maximum (air-entrained).
    - c. Mixes substantiated by lab proportioned/batched tests shall have a minimum over-design of 1,200 psi.
    - d. Test and admixture data submitted for approval shall be dated within 12 months of the review date.
  3. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
    - a. Ramps and Sloping Surfaces: Not more than three (3)-inches.
    - b. Slabs on Grade and Elevated Slabs: Not more than five (5)-inches.
    - c. Reinforced Foundation and Wall Systems: Not less than two (2)-inches and not more than four (4)-inches.
    - d. Masonry Grout: Seven (7) -10-inches (with water reducer or high-range water reducer)
  4. Adjust mix designs when material characteristics, job conditions, weather, test results, or other circumstances warrant. Do not use revised concrete mixes until laboratory test data and strength results have been submitted to and reviewed by Engineer.
  5. Use air-entraining admixture in exterior exposed concrete, providing not less than 4.5-percent (4.5%) nor more than seven (7)-percent entrained air.
  6. Use water-reducing, accelerating, and retarding admixtures that have been tested and accepted in mix designs in strict compliance with manufacturer's directions.
  7. Ready-Mix Concrete: ASTM C 94.

#### 1.4 EXECUTION

- A. Formwork: Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Select form materials to obtain required finishes.

1. Maintain formwork tolerances and surface irregularities within ACI 347 limits, Class A tolerances for concrete exposed to view and Class C tolerances for other concrete surfaces.
  2. Provide openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms.
  3. Clean and adjust forms prior to concrete placement. Apply form-release agents or wet forms as required. Retighten forms during concrete placement, if required, to eliminate mortar leaks.
- B. Vapor Barriers: Place vapor retarder/barrier membrane for slabs on grade, with joints lapped six (6)-inches and sealed. **All penetrations shall be sealed with Stego brand mastic and/or tape.**
- C. Reinforcement: Accurately position and support reinforcement, and secure against displacement. Locate and support reinforcement to maintain minimum cover with metal chairs, runners, bolsters, spacers, and hangers as required. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- a. Install welded wire fabric in lengths as long as practicable; lap at least one (1) full mesh and lace splices with wire.
- D. Joints: Locate and install construction, isolation, and control joints as indicated or required. Locate construction joints so they do not impair strength and appearance of structure. Place isolation and control joints in slabs-on-ground to stabilize differential settlement and prevent random cracking. Joints shown on plans shall not be relocated or deleted without prior written consent of the engineer.
- E. Installation of Embedded Items: Set and build anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete prior to placing concrete. Use setting diagrams, templates, and instructions provided by others for locating and setting.
- F. Concrete Placement: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," for placing concrete in a continuous operation within planned joints or sections. Do not begin concrete placement until other affected work is completed. Do not place interior slabs-on-grade or elevated slabs until building is "dried-in" and permanent (or equivalent temporary) lighting is operational.
1. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping so that concrete is worked around reinforcement and other embedded items and into forms.
  2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.
  3. In cold weather comply with ACI 306.
  4. In hot weather comply with ACI 305.
- G. Topping/Leveling compounds shall be installed and cured in accordance with the manufacturer's recommendations.
- H. Finish of Formed Surface: As follows:
1. Smooth-Formed Finish: Provide a smooth finish for concrete surfaces exposed to view and surfaces to be covered with a coating or covering material applied directly to concrete.

Repair and patch defective areas, with fins and other projections completely removed and smoothed.

I. Monolithic Slab Finishes: As follows:

1. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish when surface water has disappeared and when concrete has stiffened sufficiently to permit operation of power-driven floats. Consolidate surface with power-driven floats or by hand-floating.
  - a. Check and level surface. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
2. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, paint, or other thin film-finish coating system.
  - a. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final power-driven troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to approximate tolerances of F(F) 30 (floor flatness) and F(L) 20 (floor levelness).
  - b. Slab tolerances: The surface of each and every individual slab pour shall be flat and level with minimum "F-numbers" of  $F_F = 50$  and  $F_L = 35$ . When the width of a slab pour exceeds the distance between two adjacent roof support columns and/or the length exceeds 150 feet, the following minimum "local" F-number values shall also be met:  $F_F = 35$  and  $F_L = 24$  when tested in accordance with ASTM E1155. Local F-number test areas shall be limited as noted below.
  - c. Local F-Number testing shall apply to an area falling between two column grids with a length limited to the distance between construction joints or 150 feet, whichever is less. When the pour distance exceeds 150 feet, test areas shall be divided into equal parts.
3. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
4. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  - a. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.

J. Curing: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, apply an evaporation-control compound according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

1. Begin initial curing as soon as free water has disappeared from exposed surfaces.
2. Apply high solids curing compound to all interior slabs which will remain exposed. Prior to turnover, apply a second coat. All applications shall be in accordance with the manufacturer's requirements.

3. All interior slabs with applied finishes shall be wet cured (Concrete shall be kept continuously moist for a minimum of 7-days by wet curing using the specified "Moisture Retaining Cover" or Absorptive Cover.).
4. Apply membrane-forming curing compound to exterior slabs, walks, and curbs as soon as final finishing operations are complete. Apply uniformly according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
5. Maintain continuity of coating and repair damage during curing period.

K. Field Quality Control: Perform sampling and testing during concrete placement, as follows:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
  - a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
  - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
  - c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees Fahrenheit (four 94)-degrees Celsius) and below, when 80-degrees Fahrenheit (27-deg Celsius) and above, and one (1) test for each set of compressive-strength specimens.
  - d. Compression Test Specimen: ASTM C 31; one (1) set of six standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
  - e. Compressive-Strength Tests: ASTM C 39; one (1) set for each day's pour exceeding five (5)-cubic yard plus additional sets for each 50-cubic yard more than the first 25-cubic yard of each concrete class placed in any one (1) day; two specimens tested at seven (7)-days, two (2) specimens tested at 28-days, and two (2) specimen retained in reserve for later testing if required.
    - 1.) When frequency of testing will provide fewer than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five are used.
    - 2.) When strength of field-cured cylinders is less than 85-percent (85%) of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
    - 3.) Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500-psi.
    - 4.) Test results will be reported in writing to Structural Engineer, ready-mix producer, and Contractor within 24-hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28-days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven (7)-day tests and 28-day tests.
    - 5.) Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

- 6.) Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
2. Floor Flatness Testing: Required testing shall be in accordance with ASTM E1155. All interior slabs shall comply with minimums indicated above.
- a. All sales floor slab areas, and, where applicable upper sales floors, shall be tested by Harris Teeter's designated testing company. At upper sales floor slabs, both floor flatness and levelness will be tested and reported. However, levelness data will not be used as a basis for rejecting non-compliant slabs.
  - b. At areas where non-compliance is suspected by the Owner or Engineer, provide flatness testing.
  - c. Non-compliant slabs **shall be removed and replaced** at the Contractor's expense.
3. Moisture Vapor Emission: Testing shall be in accordance with ASTM F-1869. All slabs which receive resilient flooring or other mastic adhered covering shall be tested to determine the quantity of moisture vapor emission.
- a. Moisture vapor emission shall not exceed three (3)-pounds per 1,000-square feet per 24-hours.
  - b. Areas exceeding the maximum shall not be approved for installation of floor coverings.
  - c. In non-complying areas, the contractor shall perform any remedial efforts necessary to achieve compliance.

END OF SECTION 03300

