

## **DIVISION 3 - CONCRETE**

### **SECTION 03300**

#### **CAST-IN-PLACE CONCRETE**

##### **PART 1 GENERAL**

###### **1.1 WORK INCLUDED**

- A. Cast-in-place concrete as shown on the drawings.
- B. Formwork, shoring, bracing and anchorage.
- C. Reinforcing steel bars, welded steel wire fabric for cast-in-place and precast concrete.
- D. Support chairs for supporting reinforcement.

###### **1.2 RELATED SECTIONS**

###### **1.3 REFERENCES**

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ASTM C33 - Concrete Aggregates.
- C. ASTM C94 - Ready-Mixed Concrete.
- D. ASTM C150 - Portland Cement.
- E. ASTM C171 - Sheet Materials for Curing Concrete.
- F. ASTM C260 - Air-Entraining Admixtures for Concrete.
- G. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- H. ASTM C494 - Chemical Admixtures for Concrete.
- I. ASTM D2103 - Polyethylene Film and Sheeting.
- J. ASTM E1155-87 Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units)
- K. ACI 318 - Building Code Requirements for Reinforced Concrete.
- L. ACI 315 - Details and Detailing of Concrete Reinforcement.
- M. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- N. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- O. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- P. AWS D1.4 - Structural Welding Code Reinforcing Steel.
- Q. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- R. ASTM A616 - Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
- S. ASTM A617 - Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.

- T. CRSI - Manual of Practice.
- U. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
- V. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

#### 1.4 QUALITY ASSURANCE

- A. Work on the project shall conform to all requirements of ACI 301, Standard Specifications for Structural Concrete, published by the American Concrete Institute, Detroit, Michigan, except as modified by the requirements of these contract documents. Maintain copy of ACI 301 on site.
- B. Tolerances for concrete construction and materials shall conform to all requirements of ACI 117.
- C. Obtain materials from same source throughout the project.
- D. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, and Documents 63 and 65. Maintain copy of documents on site.
- E. No later than 48 hours prior to first concrete pour, assemble all personnel responsible for concrete work, including concrete supplier, testing agency, pump operator, project superintendent, structural engineer & architect for pre-pour conference.

#### 1.5 TESTS

- A. Testing and analysis of concrete will be performed under provisions of Division 1.
- B. Employ at Contractor's expense a testing laboratory to perform material evaluation tests and to design concrete mixes only. All other testing under Division 1.
- C. Submit proposed mix design for each mix to appointed firm for review prior to commencement of work.
- D. Examine batch plant, trucks for conformance with ASTM C-94. Submit results and provide list of approved truck numbers for use on project. Testing firm will take cylinders and perform slump tests in accordance with ACI 301.
- E. Tests of cement and aggregates will be performed to ensure conformance with requirements stated herein.
- F. Make three concrete test cylinders for every 50 cu yds or less of concrete placed each day, (i.e., minimum 3 cylinders per pour).
- G. Slump testing will be coordinated at the pre-construction meeting specified elsewhere in this specification. As a minimum, one slump test will be taken for each set of test cylinders taken, prior to addition of super plasticizers, and one slump test taken after addition and mixing of super plasticizers, if used.
- H. Floor Tolerance Measurements:
  - 1. Floor flatness and levelness tests shall be conducted in accordance with the provisions set forth in ASTM E1155-96 using a Dipstick Floor Profiler manufactured by Face Construction Technologies, Norfolk, VA, or engineer approved equivalent.
  - 2. Floor tolerance measurements shall be made by the Owner's testing lab within 24 hours after completion of the final troweling operation.
- I. Report additions of water or other additives.
- J. Report truck number for each test.

#### 1.6 PRODUCT DATA

- A. Submit product data under provisions of Division 1.

- B. Provide product data for specified products.

## 1.7 SHOP DRAWINGS

- A. Submit one set of reproducibles and 3 sets of blueprints. Reproducibles will be returned with review comments within 10 working days. Maintain set of shop drawings bearing engineer's review stamp on site.
- B. Do not reproduce contract drawings or details for use as shop drawings.
- C. Indicate sizes, spacings, locations and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing and supporting devices.

## 1.8 CERTIFICATES

- A. Submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

- A. Conform to ACI 301.
- B. Plywood Forms: Solid one side; sound undamaged sheets.
- C. Steel Forms: Minimum 22 gage thick stiffened to support weight of concrete with minimum deflection.
- D. Glass Fiber Reinforced Resin Type: Preformed shape, stiffened to support weight of concrete with minimum deflection.
- E. Tubular Column Type: Round, spirally wound laminated fiber material; inside surface treated with release agent.
- F. Void Forms: Moisture resistant treated paper faces; biodegradable; structurally sufficient to support weight of wet concrete until initial set; 2 inches thick.

### 2.2 CONCRETE MATERIALS

- A. Cement – Conforming to ASTM C150, Type I Portland, grey color.
- B. Fly Ash, ASTM C 618 Class C may be used as a partial replacement, not exceeding 25% by weight, for Type 1 cement.
- C. Fine and Coarse Aggregates: ASTM C33.
- D. Water: Clean and not detrimental to concrete.

### 2.3 ADMIXTURES

- A. Air Entrainment Admixture: ASTM C260.
- B. Mid-range Water Reducing Admixture: ASTM C494 Type A and Type F; Provide dosage to supply minimum 10% water reduction over a plain mix. Approved manufacturers limited to Master Builders, W.R. Grace, Euclid Chemical or Sika Corp.
- C. Water Reducing Admixture: ASTM C494 Type A; and same manufacturers as mid-range when used together.

### 2.4 ACCESSORIES

- A. Bonding Agent: Liquid concrete bonding agent as manufactured by Thoro Systems, Master Builders, Euclid Chemical or Sika, Corp.
- B. Vapor Barrier: specified elsewhere.

- C. Epoxy Adhesive: ASTM C881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.
- D. Concrete Patch Material: Product suitable for intended use by W.R. Grace, Sika Corporation or Master Builders, Inc.
- E. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 4000 psi.
- F. Flashing Reglets: Galvanized steel or Rigid PVC; longest possible lengths; alignment splines for joints; securable to formwork.
- G. Waterstops: As specified in the drawings, submit to engineer for approval.
- H. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding.
- I. Silane Weatherproofing Penetrant: SIL-ACT ATS 22 by Advanced Chemical Technologies, Masterseal SL by Master Builders, Inc. or approved generic equivalent.
- J. Membrane Curing Compound: Engineer approved product by W.R. Meadows, Sika Corp., Master Builders, Inc., Euclid Chemical Company or engineer approved equivalent.
- K. Joint Filler: preformed strips, non-extruding resilient bituminous type, of thickness indicated, complying with ASTM D1751.

## 2.5 REINFORCING MATERIALS

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade billet-steel deformed bars.
- B. Reinforcing Steel: ASTM A617, 60 ksi yield grade axle-steel deformed bars.
- C. Reinforcing Steel: ASTM A616, 60 ksi yield grade rail-steel deformed bars.
- D. Welded Steel Wire Fabric: ASTM A185 plain type, uncoated finish.
- E. Tie Wire: Minimum 16 gage annealed type.
- F. Chairs, Bar Supports: Sized and shaped for strength and support of reinforcement during installation and placement of concrete, including load bearing pad on bottom to prevent vapor barrier puncture.
- G. Chairs, Bar Supports, Adjacent to Architectural Concrete Surfaces: Plastic coated or Plastic tipped type; sized and shaped as required.
- H. Precast concrete reinforcement supports—For supporting reinforcement for slabs on grade, use concrete supports that have a surface area of not less than 8 sq in and have a compressive strength equal to or greater than the specified compressive strength of the concrete being placed.

## 2.6 FABRICATION

- A. Fabricate in accordance with ACI 315, providing concrete cover specified in ACI 318.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.

## 2.7 CONCRETE MIX

- A. Mix design in accordance with ACI 301 unless specified otherwise herein.
- B. Mix concrete in accordance with ASTM C94.
- C. Point of Delivery as used in ACI 301 and herein shall be the discharge chute of the truck at the jobsite.

D. Provide Concrete as follows unless otherwise shown on drawings:

1. Slump: 4" at the point of delivery, tolerance +/- 1".
  2. Air entrained in accordance with ACI 301 Table in Chapter 4, measured in accordance with ASTM C231:
    - a. Moderate Exposure: All concrete exposed to freezing, thawing and hydraulic pressures.
    - b. Mild Exposure: All other concrete.
  3. Compressive Strength at 28 days as 3,500 psi minimum.
  4. Minimum cement content per ACI 301 Table 4.2.2.1 for slabs.
  5. Maximum water/cement ratio including surface moisture and liquid admixtures shall be specified in the mix design and shall be as required to provide concrete with the required minimum cement content specified in ACI 301, the maximum aggregate size used, and the specified slump at the Point of Delivery.
  6. Maximum Water Soluble Chloride Ion (CI) content percent by weight of cement: 0.0%.
- E. Add mid-range water reducer as required to increase slump for type of placement but not more than 7" maximum at the Point of Delivery.
- F. Use accelerating admixtures when approved by Architect/Engineer.
- G. Use set-retarding admixtures when approved by Architect/Engineer.
- H. Use water reducing admixture when ambient temperature is above 75<sup>0</sup> F.
- I. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
- J. Do not add water at jobsite.

## PART 3 EXECUTION

### 3.1 SLABS ON GRADE

- A. Verify density of subgrade soil in accordance with contract drawings.

### 3.2 FORMWORK ERECTION

- A. Verify lines, levels, and measurement before proceeding with formwork.
- B. Hand trim sides and bottom of earth forms; remove loose dirt.
- C. Align form joints.
- D. Do not apply form release agent where concrete surfaces receive special finishes or applied coatings which may be affected by agent.
- E. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

### 3.3 PLACING REINFORCEMENT

- A. Before placing concrete, clean reinforcement of foreign particles or coatings. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.
- B. Do not displace or damage vapor barrier.

### 3.4 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.
- B. Install vapor barrier under slabs on grade.

### 3.5 PLACING CONCRETE

- A. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.
- B. Place concrete in accordance with ACI 301.
- C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- D. Maintain concrete cover around reinforcing in accordance with ACI 318 unless indicated on drawings.
- E. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Separate slabs on fill from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.
- G. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

### 3.6 FINISHING

- A. Provide concrete surfaces to be left exposed-to-view with smooth formed finish unless otherwise indicated.
- B. Provide concrete walkway surfaces with broom finish.
- C. Floor Finish Tolerance Measurement Method in accordance with ASTM E1155-87 and ACI 117-90 Section 4.5.6.
- D. Local Flatness / Levelness Tolerance:
  - 1. Interior slab on grade shall conform to the following ACI F-Number requirements:
    - a. Specified Overall Value:  $F_{F25} / F_{L20}$
    - b. Minimum Local Value:  $F_{F17} / F_{L15}$
- E. Pitch to drains 1/4 inch per foot nominal.

### 3.7 CURING

- A. For other concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing:
  - 1. Ponding or continuous sprinkling.
  - 2. Application of absorptive mats or fabric kept continuously wet.
  - 3. Continuous application of steam (not exceeding 150 F) or mist spray.
  - 4. Application of waterproof sheet materials, conforming to ASTM C171.
  - 5. Application of curing compound conforming to ASTM C309. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proven that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications.

- B. Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal, the concrete shall be cured until the end of the time prescribed in the following by one of the methods described above.

### 3.8 PATCHING

- A. Notify Architect/Engineer immediately upon removal of forms.
- B. Patch imperfections.

### 3.9 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.
- B. Repair or replace concrete not properly placed or of the specified type.

### 3.10 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Maintain records of date, location of pour, quantity, air temperature, and number of test samples taken.

### 3.11 PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Protect membrane from damage until placement of concrete.

END OF SECTION 03300