

**SECTION 03 30 00 - CAST IN PLACE CONCRETE****PART 1 GENERAL****1.1 DESCRIPTION**

- A. Basic specification: Perform work of this Section according to ACI 301 99, "Specifications for Structural Concrete for Buildings", except as specifically modified herein. Numbers in parentheses (0.00) indicate a related paragraph of ACI 301.
- B. Work included: All cast in place concrete work shown on the Drawings and required by these Specifications. Allow for the installation of cast in items furnished under other Sections.
- C. Provide concrete pads, piers, curbs, and bases required for equipment of all trades. Coordinate dimensions and details with requirements of equipment being supplied, prior to placing concrete.
- D. Cooperate with other trades who will provide and install items of work (sleeves, piping, conduit, inserts, etc.) to be cast in the concrete. Place no concrete until all such items are in place.
- E. Inspection and testing services required by this Section to establish mix designs are to be performed by an agency retained by the Contractor (1.6.3).
- F. Related work specified elsewhere: The general provisions of the Contract apply to the work of this Section, as though reproduced herein. Carefully examine all other Sections and all Drawings for related work, which includes but is not limited to:
  - 1. Concrete Repair: Section 03 30 20

**1.2 QUALITY ASSURANCE**

- A. Reference standards:
  - 1. ACI 318, Building Code Requirements for Reinforced Concrete.
  - 2. ACI 315R, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
  - 3. ACI 347R, Guide to Formwork for Concrete.
  - 4. "Placing Reinforcing Bars", CRSI & WCRSI Recommended Practices.

**1.3 SUBMITTALS**

- A. Submit for approval the name of the agency proposed for the required inspection and testing services. If some or all of the required testing is to be performed by personnel not employed by the proposed agency, submit letter from the agency stating that those personnel are qualified to perform the tests.
- B. Submit a mix design for each class of concrete required (1.6.3). Concrete proportions shall be established on the basis of previous field experience or trial mixtures (4.2.3).
- C. Submit shop drawings for all reinforcing. Indicate strength, size, and details of all bar reinforcing, and style and specification of all welded wire fabric (3.1.1).
- D. Submit aggregate sample for exposed aggregate sidewalks, and proposed procedure for exposing the aggregate.
- E. Submit, on request only, product literature for admixtures and curing compounds proposed for use.
- F. Submit reports of all required testing and inspection.

#### 1.4 FIELD REFERENCE MANUALS

- B. Provide at least one copy of the ACI Field Reference Manual, SP 15 (1.3.3), and one copy of CRSI's "Placing Reinforcing Bars", in the field office at all times.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Cement (4.2.1.1): Portland Cement, ASTM C150, Type I. Type II or III (high early strength) may be used with written approval and at the Contractor's expense. All cement for concrete exposed to view to be from the same mill.
- B. Water: Potable.
- C. Aggregates: ASTM C33, (4.2.1.2). Use size no. 8 for coarse aggregate in patches or concrete less than 2" in thickness. For all other classes, use size no. 57.
- D. Aggregates: ASTM C330 (for ight weight concrete.

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- E. Admixtures (where required or permitted):
  - 1. Water reducing: ASTM C494, Type A or D (4.2.1.4).
  - 2. Mid-range water-reducing admixture: ASTM C494, Type A (4.2.1.4).
  - 3. Air entraining: ASTM C260 (4.2.1.4).
  - 4. High-range water-reducing admixture (superplasticizer): ASTM C494, Type F or G (4.2.1.4).
  - 5. Non chloride, non corrosive accelerator: ASTM C494, Type C or E (4.2.1.4).
  - 6. Fly ash: ASTM C618, Type C or F (4.2.1.1.c).
  - 7. Ground granulated blast-furnace slag: ASTM C989 (4.2.1.1.d).
  - 8. Calcium chloride is NOT permitted (4.2.2.6).
  - 9. Use of admixtures other than those listed will be permitted only when approved prior to bid.
  
- F. Reinforcing (3.2.1):
  - 1. Deformed bars: ASTM A615. Minimum yield strength to be 60 ksi.
  - 2. Welded wire fabric: ASTM A185. Provide in sheet form for all uses other than slabs on grade.
  
- G. Premolded expansion joint filler: ASTM D1751, (2.2.1.4).
  
- H. Curing compound and sealer: ASTM C309 moisture retention. The compound shall be a water based membrane forming liquid, 15% solids content minimum. The following are acceptable:
  - 1. Super Diamond Clear VOX, by Euclid.
  - 2. Super Aqua - Cure VOX, by Euclid.
  - 3. Masterkure 200W, by Master Builders.
  
- I. Grout for masonry core fill: ASTM C476, coarse type.
  
- J. Granular Fill below slabs on grade: 4" of ODOT 304 or approved equal.

**2.2 MIXES**

The following classes of concrete are required (4.2.2.8):

Type	F'c (28 day)	Min. Cement	Maximum	Air Content
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		Content	Water Cement Ratio	
Class I	4,000 PSI	564	0.48	4 to 6%
exterior flat work, and any concrete exposed to weather				

1. Thin slabs: No. 8 coarse aggregate.
2. Slump: Maximum 5" for all members. If a superplasticizer is used, initial slump to be 3", increased to 8" maximum after addition (at the job site) of the superplasticizer.
3. Fly ash is permitted, but shall not exceed 15% of cement weight indicated above and can be included in the water-to-cement ratio.
4. Mixes to be pumped are to be so identified on the mix design submittal. All pumped mixes are to have a mid-range or high-range water reducer.
5. All admixtures (other than superplasticizer) are to be added at the batch plant. Superplasticizers, designed for addition to the mix at the plant, may be added at the batch plant with verification from the Structural Engineer and verification that the water-to-cement ratio has not been exceeded.
6. Ground granulated blast-furnace slag is permitted in all classes but shall not exceed 35% of the cement weight indicated above and can be included in the water-to-cement ratio.

A. Lightweight Structural Concrete: Maximum air-dryweight 120 PCF..

### PART 3 EXECUTION

#### 3.1 SURFACE CONDITIONS

- A. Verify that excavations are free of water and ice, are of the required dimensions, and have been approved by the Soils Engineer, prior to placing concrete (5.3.1).
- B. Determine field conditions by actual measurement.
- C. Notify Architect not less than 24 hours in advance of placing concrete. Place concrete only when Architect is present, unless this requirement is specifically waived.

#### 3.2 FORMWORK

- A. Removal of forms and shoring:

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1. Remove no forms within 24 hours after placement.
2. Shoring is to remain in place until concrete reaches its design strength. Windsor Penetrometer is to be used to verify in place strength if forms are removed prior to 28 days after casting concrete.

### 3.4 JOINTING

- A. Exterior slabs on grade: Locate joints as shown on Drawings. In the absence of information on Drawings, provide the following (for sidewalks only):
1. Expansion joints: Full depth, with 1/2 inch joint filler, where slabs abut vertical surfaces at intersections of sidewalks, at abrupt changes in width, and at a spacing not exceeding 30 feet.
  2. Control joints: Tooled, 1 inch deep, 4' 0" to 6' 0" on center between expansion joints.

### 3.5 FINISHES

- A. Schedule of finishes on flatwork is as follows:  
B. 1. Exterior slabs broom finish (5.3.4.2.d).

### 3.6 CURING AND PROTECTION

- A. Temperature:
1. When air temperature during placement is less than 40 degrees, or will be within 24 hours, temperature of concrete as placed is to be between 50 and 90 degrees (55 and 90 degrees for sections less than 12 inches thick) and a non-chloride accelerator shall be used. Maintain concrete temperature within these limits for the full curing period of 7 days. (4.2.2.7 and 5.3.1.6).
  2. When air temperature during placement is greater than 80 degrees, a water-reducing retarder shall be used.
- B. Curing:
3. Whichever curing method is used, it is to commence immediately after placement (5.3.6.1). Do not allow curing to be delayed overnight.
  4. Prevent excessive moisture loss from formed surfaces (5.3.6.3). If forms are removed before 7 days have elapsed, cure the formed surfaces by moist curing or application of curing compound for the remainder of the curing period.

### 3.7 FIELD QUALITY CONTROL

- A. Obtain concrete for required tests at point of placement. If concrete is pumped, obtain concrete for tests at discharge end (1.6.4.3).
- B. For each concrete class other than lean concrete, perform one strength test for each 50 yards or fraction thereof, for one day placement of up to 300 yards (1.6.4.2.d). Perform one strength test for each 100 yards or fraction thereof, for one day placements of greater than 300 yards.
- C. Determine slump for each strength test (1.6.4.2.f).
- D. Determine air content for each strength test of Class I concrete (1.6.4.2.h).
- E. Determine concrete temperature for each strength test (1.6.4.2.g).
- F. Do not place concrete when slump, air content, or temperature vary from allowable (1.6.8).
- G. Maintain records of all tests, indicating exact location of the structure represented by each test.
- H. Test cylinders shall be stored at the jobsite for the first 20 hours, plus or minus 4 hours, in a protected location, with the temperature maintained between 60 and 80 degrees, or the results of the strength tests shall be considered unacceptable.
- I. All field testing and inspections shall be performed by an ACI Concrete Field Testing Technician Grade 1, or equivalent (16.2).

END OF SECTION 033000

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### SECTION 03 30 20 - CONCRETE REPAIR

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Work of this Section includes: All labor and materials required to furnish and install the concrete restoration and patching work shown on the Drawings and required by these Specifications.
- B. Related work specified elsewhere: The general provisions of the Contract apply to the work of this Section, as though reproduced herein. Carefully, examine all other Sections and Drawings for related work, which includes, but is not limited to:
  - 1. Cast-in-Place Concrete: Section 03 30 00

##### 1.2 QUALITY ASSURANCE

- A. Contractor's Qualifications:
  - 1. Contractor shall not have less than 5 years continuous experience in concrete repairs of this type and extent.
- B. Warranty:
  - 1. Contractor shall warrant materials and installation to be free from defects for a period of one (1) year from date of acceptance of the project by the Owner. Any failure of materials installed under this contract that occur during the warranty period shall be repaired promptly and at no cost to the Owner. This warranty shall be in addition to any guarantee or warranty provided by the material manufacturer(s).

##### 1.3 SUBMITTALS

- A. Submit manufacturer's Product Data Sheets, application instructions, and applicable MSDS sheets for all specified repair materials that are to be used on this project.

##### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered to the project in their original containers bearing the Manufacturer's name, product label, formulation, and lot or batch number.
- B. All containers shall be new and unopened.
- C. All containers shall be clearly marked with any required SPI hazardous material rating and appropriate warnings for handling and use.
- D. All materials shall be stored in their original, water tight containers in a covered area where they shall not be exposed to excessive heat, sparks, flame, direct sunlight, water, or damp surfaces. Water-based materials shall be protected against freezing.

- E. Damaged, outdated or deteriorated materials shall not be used in the work and shall be removed from the project immediately.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Only one manufacturer shall be used for materials requiring multi-part mixtures to insure compatibility.
- B. Provide bonding agents (primers) as recommended by the Manufacturer for the substrates included in the work.

### 2.2 MATERIALS

- A. The following materials are approved for use on this project:
  1. Horizontal Concrete Patching: "Quick 1000" by Sika Corporation, "Versa Speed" by Tamms, "Emaco 310" by Master Builders.
  2. Vertical Concrete Patching: "Sikatop 123 Plus" by Sika Corporation, "Speed Crete Redline" by Tamms, "Emaco S88" by Master Builders.
  3. Coarse Aggregate for patch material extension: #8 aggregate, quartz or limestone.
  4. Bond-Enhancing, Corrosion-Inhibiting Coating: "Armatec 110" by Sika Corporation, "Corr-Bond" by Euclid Chemical, "P24" by Master Builders.
  5. Ready Mixed Concrete as required: 4,000 psi 28-day strength, 4 to 6 percent entrained air, minimum cement content = 564 pounds per cubic yard, max w/c ratio = .48.
  6. Urethane Sealant: "NP 1" by Sonneborn, "Sikaflex 1a" by Sika Corporation, "Eucolastic 1" by Euclid Chemical.
  7. Reinforcing: Deformed bars, ASTM A615. Minimum yield strength = 60 ksi.
  8. Curing Compound: "Cure-n-Seal WB" by Sonneborn, "Aqua Cure Vox" by Euclid Chemical.
  9. Elastomeric Surface Coating: "Elastocolor" by Sika Corporation, "Flexcoat" by Sonneborn, "Neoflex" by Neogard.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

- A. Sound all existing concrete surfaces to determine areas of delamination. Except for small spalls (less than 6" in any dimension), mark and sawcut perimeters of areas to be repaired. Maximum depth of cut to be 1/2". Do NOT cut or damage reinforcing steel.
- B. Use small, pneumatic or electric hand tools to effect removal of unsound materials. Expose corroded reinforcing by undercutting at least 1/2". Equipment that induces excessive vibrations in the original concrete will not be permitted.
- C. Clean loose rust from reinforcing by wire-brushing. Prepared concrete surface to be cleaned of dust and loose material.

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- D. Coat exposed reinforcing and patch surfaces with cement based, anti-corrosion and bond enhancing material. Follow manufacturer guidelines regarding patch installation over bond enhancing material. Re-coat patch substrates if site conditions or schedule as set forth by the manufacturer require it.
- E. Install formwork as required to match existing concrete surfaces.

### 3.2 INSTALLATION

- A. All material shall be installed in accordance with the printed instructions of the manufacturer of the repair material being used. The use of a slurry bond coat is acceptable provided that the application of the slurry bond coat is in accordance with the recommendations of the material manufacturer. Bond coat is to be composed of similar materials as that being placed. Exposed reinforcing shall be coated with corrosion inhibiting material as outlined above.
- B. Placement and Finishing: Do not deviate from the procedures or conditions recommended by the manufacturer of the repair material being used. The repair material shall be placed as rapidly as possible into the area being repaired and finishing operations shall begin immediately after set. Patch material shall be worked into the edges of the patch area to assure a tight joint. Finished edges shall meet blend smoothly with the surrounding concrete. Match existing concrete textures as closely as possible. The repair area shall be filled completely following manufacturer guidelines regarding placement. When placing against repair material that has already set, apply a bond coat in accordance with the above procedures and as recommended by the manufacturer.
- C. Curing: All patches shall be cured in strict accordance with the manufacturer's written recommendations. The materials specified require covering or other means to insure hydration. In areas exposed to direct sun or wind, the Contractor may have to cover patches with a polyethylene vapor barrier material immediately after finishing to prevent rapid drying and plastic shrinkage cracking. Edges of plastic should be taped or otherwise sealed to prevent loss of moisture. Patching materials, shall be cured for at least 24 hours but not less than the standards set forth by the patching material installation instructions. Curing shall begin immediately after finishing operations are complete. Commercial curing compounds may be used at the Contractor's discretion. Only water based commercial curing compounds are permitted. Follow manufacturer written recommendations regarding application methods and rates.

END OF SECTION 033020

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