

DIVISION 3

CONCRETE

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ARCHITECTURE
INTERIOR DESIGN
PLANNING



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SECTION 03301

CAST-IN-PLACE CONCRETE REPAIR

PART 1 - GENERAL

1.1 SUMMARY

- A. **Section Includes:** Cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes, for the following:
 - 1. Patching floor slabs.
- B. **Related Sections:**
 - 1. Section 01450 - Testing Laboratory Services.

1.2 SUBMITTALS

- A. **Product Data:** Submit manufacturer's descriptive literature and application recommendations for reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and other proprietary materials and items if requested by Architect.
- B. **Shop Drawings:** Submit details for fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, spacing, bent bar diagrams, and arrangement of concrete reinforcement, ties, and stirrups. Include special reinforcing for openings through concrete.
- C. **Mix Design Data:** Submit laboratory test reports or evaluation reports for concrete materials and each proposed concrete mix.
 - 1. The Contractor shall engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.
 - 2. Submit written mix design data at least 15 days prior to scheduled start of concrete placement.
 - 3. Do not begin concrete production until mix designs have been reviewed by the Architect.

1.3 QUALITY ASSURANCE

- A. **Codes and Standards:** Comply with provisions of the following, except where more stringent requirements are shown or specified:
 - 1. ACI 301, "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. **Concrete Testing Service:** As specified in PART 3 of this Section.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. **General:** Furnish form materials capable of supporting construction loads in addition to weight of fresh concrete, without displacement or excessive deflection.

- B. **Forms for Exposed Concrete:** Plywood, metal, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints.
- C. **Forms for Unexposed Concrete:** Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- D. **Form Release Agent:** Commercial formulation that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- E. **Form Ties:** Factory-fabricated, adjustable-length, removable or snap-off metal form ties that will leave no metal closer than 1-1/2 inches to the exposed concrete surface.

2.2 REINFORCING MATERIALS

- A. **Reinforcing Bars:** ASTM A 615, Grade 60, deformed.
- B. **Welded Wire Fabric:** ASTM A 185, welded steel wire fabric.
- C. **Supports for Reinforcement:** Bolsters, chairs, spacers, and other devices for spacing, supporting, and positioning reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners.
 - 2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.3 CONCRETE MATERIALS

- A. **Portland Cement:** ASTM C 150, Type I.
- B. **Fly Ash:** ASTM C 618, Type C.
- C. **Normal Weight Aggregates:** Normal-Weight, ASTM C 33, except local aggregates proven by special tests or actual service to produce concrete of adequate strength and durability may be used, subject to acceptance by Architect.
- D. **Water:** Potable.

2.4 ADMIXTURES

- A. **General:** Provide concrete admixtures that are compatible with other concrete ingredients and that contain not more than 0.1 percent chloride ions.
- B. **Air-Entraining Admixture:** ASTM C 260.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Air-Mix or Perma-Air, Euclid Chemical Co.
 - b. Darex AEA or Daravair, W.R. Grace & Co.
 - c. MB-VR or Micro-Air, Master Builders, Inc.
 - d. Sika AER, Sika Corp.
- C. **Water-Reducing Admixture:** ASTM C 494, Type A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Eucon WR-75, Euclid Chemical Co.

- b. WRDA, W.R. Grace & Co.
 - c. Pozzolith Normal or Polyheed, Master Builders, Inc.
 - d. Plastocrete 161, Sika Corp.
- D. High-Range Water-Reducing Admixture:** ASTM C 494, Type F or Type G.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Eucon 37, Euclid Chemical Co.
 - b. WRDA 19 or Daracem, W.R. Grace & Co.
 - c. Rheobuild or Polyheed, Master Builders, Inc.
 - d. Sikament 300, Sika Corp.
- E. Water-Reducing, Accelerating Admixture:** ASTM C 494, Type E.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accelguard 80, Euclid Chemical Co.
 - b. Daraset, W.R. Grace & Co.
 - c. Pozzutec 20, Master Builders, Inc.
- F. Water-Reducing, Retarding Admixture:** ASTM C 494, Type D.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Eucon Retarder 75, Euclid Chemical Co.
 - b. Daratard-17, W.R. Grace & Co.
 - c. Pozzolith R, Master Builders, Inc.
 - d. Plastiment, Sika Corporation.

2.5 RELATED MATERIALS

- A. Expansion Joint Filler:** Non-bituminous, non-extruding cork or rubber joint filler, ASTM D 1752. Joint sealants are specified in "Section 07920 - Joint Sealers".

2.6 CURING MATERIALS

- A. Absorptive Cover:** Burlap cloth weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- B. Moisture-Retaining Cover:** Waterproof paper, polyethylene film or polyethylene-coated burlap, complying with ASTM C 171.
- C. Liquid Membrane-Forming Curing Compound:** ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.
 - b. Eucocure, Euclid Chemical Co.
 - c. L&M Cure R, L&M Construction Chemicals, Inc.
 - d. Masterkure, Master Builders, Inc.
 - e. Kure-N-Seal, Sonneborn-Chemrex.
- D. Water-Based Membrane Curing Compound:** Acrylic formulation, ASTM C 309, Type I, Class B.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aqua-Cure, Euclid Chemical Co.
 - b. Dress & Seal WB, L&M Construction Chemicals, Inc.

c. Masterkure 100W, Master Builders, Inc.

E. Evaporation Control: Monomolecular film-forming compound intended for application to fresh concrete for temporary protection against rapid moisture loss.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Eucobar, Euclid Chemical Co.
 - b. E-Con, L&M Construction Chemicals, Inc.
 - c. Confilm, Master Builders, Inc.

2.7 CONCRETE SEALER (IF REQUIRED BY DRAWINGS)

A. Clear Concrete Sealer: Colorless solution which penetrates the surface of the concrete to seal, densify and harden the surface:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ashford Formula - Curecrete Chemical Co.
 - b. Seal Hard - L&M Construction Chemicals, Inc.

2.8 ADHESIVE

A. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Euco Epoxy System #452 or #620, Euclid Chemical Co.
 - b. Epabond, L&M Construction Chemicals, Inc.
 - c. Congresive Standard Liquid, Master Builders, Inc.
 - d. Sikadur 32 Hi-Mod, Sika Corp.

2.9 PROPORTIONING AND DESIGNING MIXES

A. General: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. Comply with "SUBMITTALS" provisions in PART 1 of this Section.

1. Limit use of fly ash to not exceed 15 percent of cement content by weight.
2. Limit water/cement ratio of concrete exposed to freezing to 0.45.

B. Slump Limits: Design mixes for concrete slump at point of placement as follows:

1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.
2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
4. Other concrete: Not more than 4 inches.

C. Adjustment to Concrete Mixes: Adjust mix design when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Do not use revised mix designs until test data and strength results have been submitted to and accepted by the Architect.

2.10 ADMIXTURES

A. General: Use only admixtures that have been accepted in mix designs. Use admixtures in accordance with manufacturer's directions and recommendations.

B. Use of Admixtures: Use water-reducing admixture in concrete, as necessary for placement and workability.

1. Use accelerating admixture in concrete placed at ambient temperatures below 50 deg F (10 deg C).
2. Use high-range water-reducing admixture in pumped concrete, concrete with water-cement ratios below 0.50, and elsewhere only as instructed.
3. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated, to result in concrete at point of placement having total air content from 2 to 4 percent.

2.11 CONCRETE MIXING

- A. **Ready-Mixed Concrete:** Use ready-mixed concrete throughout, unless otherwise approved by the Architect. Comply with requirements of ASTM C 94, and as specified.
- B. **Hot Weather Mixing:** When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 GENERAL

- A. **Coordination:** Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

- A. **General:** Design, erect, support, brace, and maintain formwork to resist wind loads and to support vertical, lateral, static, and dynamic loads of concrete and subsequent operations until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.
- B. **Formwork Construction:** Fabricate forms for easy removal without hammering or prying against concrete surfaces. Kerf wood inserts for keyways, reglets, recesses, and similar features for easy removal.
 1. Provide necessary temporary openings for clean-outs and inspections before and during concrete placement. Locate temporary openings at inconspicuous locations.
 2. Chamfer exposed corners and edges as indicated.
 3. Apply form release agent or wet forms as necessary.
- C. **Provisions for Other Trades:** Provide openings in formwork to accommodate work of other trades. Accurately place and securely support sleeves and other items built into forms.
- D. **Forms for Slabs:** Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and securely support screed strips for use with strike-off templates or compacting-type screeds.
- E. **Cleaning and Tightening:** Thoroughly clean forms and adjacent surfaces prior to concrete placement. Retighten forms and bracing during placement if necessary to prevent mortar leaks and maintain proper alignment.

3.3 REINFORCEMENT

- A. **General:** Comply with Concrete Reinforcing Steel Institute's recommended practice for details and methods of reinforcement placement and supports.
 1. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

2. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, and wire ties. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 3. Maintain minimum coverages as indicated.
- B. Welded Wire Fabric:** Install welded wire fabric in lengths as long as practicable. Lap at least one full mesh and tie splices with wire. Offset laps of adjoining widths to prevent continuous laps in both directions.

3.4 JOINTS

- A. Construction Joints:** Locate and install construction joints so they do not impair strength or appearance of the structure.
1. Provide keyways at least 1-1/2 inches deep in construction joints.
 2. Place construction joints perpendicular to main reinforcement and continue reinforcement across construction joints unless indicated otherwise.
 3. Use bonding agent on concrete surfaces that will be joined with fresh concrete.

3.5 SCHEDULING CONCRETE PLACEMENT

- A. Notify Architect** and request inspection no later than twenty-four (24) hours before any portion of concrete is scheduled to be poured.
1. In no case are requests for inspection to be made until formwork is erected, braced and tightened; reinforcing, accessories, expansion joint fillers, embedded items and work of other trades are in place and all preparation work is complete and conditions are ready to receive concrete.
 2. Forms for walls shall have one side open to allow proper inspection of reinforcing.
 3. Twenty-four (24) hours notice is also required for reinspection work found to be in non-conformance by the Architect.

3.6 CONCRETE PLACEMENT

- A. General:** Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete". Deposit concrete continuously so that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified.
1. Deposit concrete to avoid segregation at its final location.
 2. Maintain reinforcing in proper position during concrete placement.
- B. Consolidation:** Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping in compliance with ACI 309. Do not use vibrators to transport concrete inside forms. Limit vibration to time necessary to consolidate concrete and embed reinforcement and other items without causing mix to segregate.
- C. Placing Concrete Slabs:** Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- D. Cold-Weather Placement:** Comply with ACI 306 and the following. Protect concrete work from physical damage or reduced strength from frost, freezing actions, or low temperatures.
1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 2. Do not use calcium chloride, salt, or other antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

- E. **Hot-Weather Placement:** Comply with ACI 305 and the following. Protect concrete work from reduced strength and impaired quality from too-rapid drying and elevated temperature.
1. Water-fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 2. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, if acceptable to Architect.

3.7 FORMED SURFACES FINISHES

- A. **Rough-Formed Finish:** Provide concrete surfaces not exposed to view in the finished construction with texture imparted by form material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding $\frac{1}{4}$ inch in height rubbed down or chipped off.
- B. **Smooth-Formed Finish:** Provide concrete surfaces exposed to view or to be covered with a coating or covering material applied directly to concrete (such as waterproofing, dampproofing, veneer plaster, or similar system). with an as-cast surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective concrete areas. Fins and other projections shall be completely removed and smoothed.
- C. **Smooth-Rubbed Finish:** Provide smooth-rubbed finish within 24 hours after form removal on concrete surfaces to be painted or left exposed at occupied rooms and spaces in the completed construction. In addition to smooth-formed finish as specified, moisten concrete surfaces and rub with carborundum brick or another abrasive to produce a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

3.8 MONOLITHIC SLAB FINISHES

- A. **General:** Verify required slab finishes with Architect before concrete is placed. Slope surfaces uniformly to drains where required.
- B. **Scratch Finish:** Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- C. **Float Finish:** Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing and roof insulation, or sand-bed terrazzo; and where indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared and concrete has stiffened sufficiently to permit operation of power-driven floats. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Produce a uniform, smooth, granular texture.
 2. Finish surfaces to tolerances specified. Cut down high spots and fill low spots; refloat such corrections.
- D. **Trowel Finish:** Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, adhesive-set ceramic or quarry tile, paint, or other thin-film coating system or adhesive-set finish.
1. After floating, begin first trowel-finish operation using a power-driven trowel when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance.
 2. Finish surfaces to tolerances specified. After concrete has hardened, grind smooth surface defects that would telegraph through applied floor covering system.

