

DIVISION **3**

CONCRETE

Sizeier Thompson Brown Architects
300 Lafayette Street, Suite 200
New Orleans, LA 70130
Phone: 504-523-6472
Fax: 504-529-1181

www.sizeierthompsonbrown.com



SECTION 03300

CAST-IN-PLACE CONCRETE

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. Pile caps.
 - 2. Foundations and gradebeams.
 - 3. Floor slabs.
 - 4. Equipment pads and bases

- B. Related Sections:
 - 1. Section 01450 - Testing Laboratory Services.
 - 2. Section 02200 - Earthwork: Grading and compaction under concrete structures.
 - 3. Section 02750 - Portland Cement Concrete Paving: Sidewalks, driveways, parking areas, and other non-building concrete.
 - 4. Section 05512 - Pre-Fabricated Metal Stairs: Steel pan stairs.
 - 4. Section 02764 - Pavement Joint Sealants.
 - 5. Division 15: Equipment bases.

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.
 - 2. 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.
- E. Slag: Not acceptable.
- F. Fiber Reinforcement:
 - 1. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, ½ to 1 inch (13 to 25mm) long.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrillated Fibers:
 - 1. Fibrasol F; Axim Concrete Technologies
 - 2. Fibermesh; Fibermesh, Div. of Synthetic Industries
 - 3. Forta CR; Forta Corporation
 - 4. Grace Fibers; W.R. Grace & Co., Construction Products Division
- G. Lightweight Aggregates ASTM C330.
- H. Waterproofing:
 - 1. Xypex Admin C-1000.
 - 2. The concrete waterproofing admixture shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete.
 - 3. The design shall include the use of the crystalline waterproofing repair materials that generate a non-soluble crystalline formation in the concrete.
 - 4. The concrete crystalline waterproofing admixture shall be specifically formulated as a concrete admixture.
 - 5. The dosage rate for the Xypex Admix C-1000 shall be 3% by weight of cement.
 - 6. Crack Bridging Capability: Requirement: Crystalline Waterproofing shall be capable of sealing static cracks up to 1/64" .

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.

- B. Vapor Retarder: 10 mil polyethylene sheet vapor retarder that is resistant to deterioration when tested according to ASTM E154.

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. Curing and sealing compound must be compatible with flooring products.
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.
- F. Hardened Wear-Resistance Finish: Packaged dry combination of materials consisting of Portland cement, graded quartz aggregate, and plasticizing admixture, natural cement color.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Surfex, Euclid Chemical Co.
 - b. Quartz Plate, L&M Construction Chemicals, Inc.
 - c. Maximent, Master Builders, Inc.
 - d. Mastercron F.F.
 - e. Harcol Redi-Mixed, Sonneborn-Chemrex
 2. Curing Compound: Where hardened finish is applied, use only curing compound manufactured and recommended by the hardener manufacturer. Available products include:
 - a. Euco Floor Coat, Euclid Chemical Co.
 - b. Dress & Seal 30, L&M Construction Chemicals, Inc.
 - c. Mastercron, Master Builders, Inc.
 - d. Sonosil, Sonneborn-Chemrex

2.7 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. Concsive Standard Liquid, Master Builders, Inc.
 - d. Sikadur 32 Hi-Mod, Sika Corp.

2.8 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.
 - 3. Limit water/cement ratio of first floor slab concrete 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.

2.9 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.

2.10 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.
- B. Tolerances: Control form construction, reinforcement placement, and placing and finishing concrete to meet the following requirements in the completed construction.
 - 1. Slab Surfaces - Maximum variation from true plane and levelness will be as follows: F25; FL20.
 - 2. Other Exposed Surfaces and Edges -
 - a. Cross section dimension: Minus 1/4", plus 1/2".
 - b. Variation from indicated level: ±1/4" in 10 feet; ± 1/2" max.
 - c. Variation from plumb: ±1/4" in 10 feet; ±1/2" max.
 - d. Variation from true line: ±1/4" in 10 feet; ±3/8" in 20 feet; ±1/2" max.
 - e. Alignment of columns and walls (bottom versus top): ±1/2".
 - f. Location in plan: ±1/2" in 20 feet; ±3/4" max.
 - 3. Reinforcement Placement -
 - a. Concrete cover: Plus 1/4", minus 0.
 - b. Spacing of parallel bars: ±1/4".
 - c. Length of bars: ±1".
 - d. Vertical or horizontal displacement: One bar diameter.

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 Tolerances: Maintain formwork construction tolerances and surface irregularities within ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
 4. Provide Class C tolerances for other concrete surfaces.
- C. Embedded Items: Set and build into formwork reglets, dovetail slots, anchorage devices, sleeves, and other embedded items for work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- D. 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.
- E. 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.
1. The forming Contractor shall coordinate slab and beam blockouts and weld plates with the exterior wall manufacturer.
- F. 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.
- G. 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.
- H. Vapor Retarder: Provide vapor retarder sheeting for all slabs on grade. Place sheeting with longest dimension parallel with direction of pour.
1. Lap joints and seal with mastic or pressure-sensitive tape.
 2. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- I. Earth Cuts as Forms: All building pile caps, foundation beams and walls must be wood formed. Earth cuts will not be acceptable in lieu of forms. The Contractor shall provide necessary dewatering or dry bottoms in accordance with Section 02200, without additional cost to the Owner.

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 coverage 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.
- C. Fiber Reinforcement: Add to mix at a rate of 1.5 lb. per cubic yard unless otherwise recommended by the manufacturer. Fiber reinforcement is required in all exposed concrete.

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 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.

3.6 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 ¼ 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.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces.

3.7 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.
- E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- F. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Uniformly slope exterior surfaces to eliminate "bird baths". Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route.
- G. Hardened Wear-Resistant Finish: Apply a hardened wear-resistant finish to monolithic slab surfaces indicated.
1. Apply dry shake materials for the hardened wear-resistant finish at a rate of 100 lb. to 200 lb. per 100 sq. ft., unless a greater amount is recommended by material manufacturer.
 2. Quality Assurance:
 - a. Job Mock-Up: In a location designated by the Architect/Engineer, place a minimum 100 ft² (10 m²) floor mock-up using materials and procedures proposed for use in the project. Revise materials and procedures as directed by the Architect/Engineer to obtain acceptable finish surface.

1. Maintain the same controls and procedures used in the acceptable mock-up throughout the project.
- b. Field Support: During job mock-up and initial period of installation, the manufacturer of the surface hardener will provide, at no cost, a trained, fulltime employee to aid in securing proper use of the product.
 1. Notify surface hardener manufacturer at least three days prior to initial use of the product.
- c. Installer Qualifications: Engage an experienced installer who has specialized in the application of floor finishes similar to that required for this project, who has demonstrated the capability of producing acceptable quality floor flatness and hand trowel finishes.
3. For wear-resistant concrete floors, provide concrete with the following additional requirements:
 - a. Maximum slump of 5 in. (12.7 cm) for slabs on grade and 3.5 inc. (8.9 cm) for suspended slabs.
 - b. Do not apply over concrete containing more than 3% air content when tested by ASTM 173 or ASTM C 231 procedures.
 - c. Do not use admixtures that increase bleeding.
 - e. Consult ACI 211 Table 6.3.6 for base concrete mix designs and additives for dry shake slabs.
 - f. Follow ACI 302 recommendations for placements of flat floors.
4. Application of Surface Hardener:
 - a. Apply material in two operations if more than 1.0 lb/ft² (4.5 kg/m²) total amount of shake is required. Place and integrate half of the total amount in the first application and the remaining half on the second application.
 - b. Following the use of the highway straightedge, apply up to 1.0 lb/ft² (4.5 kg/m²) of surface hardener per application. Distribute evenly by use of a mechanical spreader to be assured of maintaining indicated flatness values.
 - c. Use finishing machines with detachable float shoes. Compact surface by a third mechanical floating, if time and setting characteristics of the concrete will allow. Do not add water to the surface.
 - d. As surface further stiffens, indicated by loss of sheen, hand or mechanically trowel with blades set relatively flat.
5. Curing and Protection:
 - a. Cure finished floors using film-forming curing compound recommended by surface hardener manufacturer. Uniformly apply curing compound over the entire surface at a coverage that will provide moisture retention in excess of the requirements of ASTM C 309. Maintain ambient temperature of 50°F (10°C) or above during the curing period.
6. Joint Filling:
 - a. After a minimum of 90 days, apply a semi-rigid epoxy joint filler in all control and saw cut construction joints. Place joint filler in a method complying with manufacturer's label instructions.
7. Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly

distributing remainder of dry shaker material with overlapping applications to ensure uniform color, and embed by power floating.

3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations. Comply with diagrams or templates of manufacturer furnishing machines and equipment.

3.9 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from physical damage, premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather apply an evaporation-control material to slab surfaces according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Initial Curing: Begin curing as soon as free water has disappeared from concrete surface after placing and finishing. Continue curing for not less than 7 days.
- C. Curing Methods: Cure concrete by one or a combination of the following methods.
 - 1. Continuous water-fog spray, or completely cover with specified absorptive cover, thoroughly saturated with water and kept continuously wet, with sides and ends lapped 4 inches.
 - 2. Cover with moisture-retaining cover with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Use membrane curing compounds that will not affect bond or adhesion of finish materials applied directly to concrete. Apply curing compound as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
- D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and similar surfaces, by moist curing with forms in place

for the full curing period or until forms are removed. After forms are removed, continue curing by methods specified above, as applicable.

3.10 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar elements, may be removed 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may be removed when concrete has attained at least 75 percent of specified 28-day compressive strength.
- B. Form Re-Use: Clean and repair surfaces of forms to be reused. Split, frayed, delaminated, or otherwise damaged form material will not be acceptable. Apply new form-coating compound.
- C. Extending Formed Surfaces: When forms are extended for successive concrete placement, thoroughly clean forms and in-place concrete surfaces, remove fins and latence, and tighten forms to close joints. Align and secure forms to avoid offsets.

3.11 CONCRETE REPAIRS

- A. Patching Defective Areas: Immediately after removing forms, repair and patch defective areas with cement mortar consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only the amount of water necessary for handling and placing.
 - 1. Patch voids over 1/4 inch in any dimension and holes left by tie rods and bolts. Cut down to solid concrete, but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface.
 - 2. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 - 3. Correct high areas in formed and unformed surfaces by grinding after concrete has cured at least 14 days.
 - 4. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
- B. Replacing Defective Areas: Remove and replace defective concrete if defects cannot be satisfactorily patched. Defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching

concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

2. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

3.12 FIELD QUALITY CONTROL TESTING

- A. General: The testing agency specified in Section 01450 will perform tests and submit test reports. Minimum testing will be as specified below. Additional testing may be ordered by the Owner or Architect.
- B. Minimum Testing: Sampling and testing for quality control during concrete placement will include the following.
 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 2. 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.
 3. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed.
 4. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 100 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
- C. Random Sampling: When specified frequency of testing will provide fewer than five sets of cylinders for a given class of concrete, obtain samples and conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
- D. Reporting: Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests.
- E. Additional Tests: The testing agency may 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 Architect, by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 03360

UNDER-SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY:

- A. Products Supplied Under This Section:
 - 1. Vapor Barrier, seam tape, mastic, pipe boots, and detail strip for installation under concrete slabs.
 - 2. Provide this product in lieu of the product specified in section 03300 Cast-In-Place Concrete.
- B. Related Sections:
 - 1. Section 03300 Cast-In-Place Concrete

1.2 REFERENCES:

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 1745-97 - Standard specification for plastic water vapor retarders used in contact with soil or granular fill under concrete slabs.
 - 2. ASTM E 154-88- Standard test methods for water vapor retarders used in contact with earth under concrete slabs.
 - 3. ASTM E 96-95 - Standard test methods for water vapor transmission of materials.
 - 4. ASTM E 1643-98 - Standard practice for installation of water vapor retarders used in contact with earth or granular fill under concrete slabs.
- B. American Concrete Institute (ACI):
 - 1. ACI 302.1R-96 - Vapor barrier component (plastic membrane).

1.3 SUBMITTALS:

- A. Quality Control / Assurance:
 - 1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
 - 2. Manufacturer's samples, product literature
 - 3. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Vapor Barrier/ Retarder:
 - 1. Vapor Barrier membrane must have the following properties:
 - a. Manufactured from prime virgin resins
 - b. Water Vapor Barrier: ASTM E-1745 Meets or exceeds Class A
 - c. Water Vapor Transmission Rate: ASTM F-1249 0.022 perms or lower
 - d. Puncture Resistance: ASTM E-1709 minimum 2266 grams
 - e. Tensile Strength: ASTM D-882 minimum 53.2 lbf/in

- B. Vapor Barrier Products:
 - 1. Stego Wrap 10-mil Vapor Barrier by Stego Industries LLC
 - 2. Raven Industries Inc.; Vapor Block 10
 - 3. Premoulded Membrane with Plasmatic Core by W.R. Meadows
 - 4. Insulation Solutions; Viper VaporCheck II - 10 mil class A.
 - 5. Prior approved equal

2.2 ACCESSORIES:

- A. Seam Tape Products:
 - 1. Stego Tape by STEGO INDUSTRIES LLC
 - a. Minimum 4-inches wide.
 - 2. Vapor Bond Tape by Raven Industries
 - 3. Prior approved equal
- B. Vapor Proofing Mastic Products:
 - 1. Stego Mastic by STEGO INDUSTRIES LLC
 - 2. Prior approved equal
- C. Pipe Boots:
 - 1. Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.
 - 2. Pipe Boots Products:
 - a. Raven VaporBoot System
 - b. Prior approved equal.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Ensure that subsoil meets specification standards prior to proceeding.
- B. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION:

- A. Install Vapor Barrier/Retarder:
 - 1. Installation shall be in accordance with manufacturer's instructions.
 - 2. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
 - 3. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
 - 4. Overlap joints 6 inches and seal with manufacturer's tape.
 - 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 6. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
 - 7. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION