SECTION 033000  
**Cast-in-place concrete with waterstop**

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
   * + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
      1. SUMMARY
         1. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

Revise list below to suit Project.

Footings.

Foundation walls.

Slabs-on-grade.

Suspended slabs.

Concrete toppings.

Building frame members.

Building walls.

* + - * 1. Related Sections:

Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.

Section 035300 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.

Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

Section 321313 "Concrete Paving" for concrete pavement and walks.

Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

* + - 1. DEFINITIONS

Retain definition remaining after this Section has been edited.

Definition in paragraph below refers to those materials that make up the cementitious component of the water-cementitious materials ratio.

* + - * 1. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
      1. ACTION SUBMITTALS
         1. Product Data: For each type of product indicated.
         2. LEED Submittals:

Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

"Product Data for Credit IEQ 4.3" Subparagraph below applies to LEED-NC, LEED-CI, and LEED-CS; coordinate with requirements selected in Part 2.

Product Data for Credit IEQ 4.3: For [**liquid floor treatments**] [**and**] [**curing and sealing compounds**], documentation including printed statement of VOC content.

Retain subparagraph below if fly ash, ground granulated blast-furnace slag, silica fume, or other materials are used as portland cement replacements for LEED Credit ID 1.1. To achieve this credit, replacement materials must be substituted for at least 40 percent of the portland cement that would otherwise be used.

Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.

Design mixtures in first paragraph below are usually considered to be an action submittal.

* + - * 1. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

Indicate amounts of mixing water to be withheld for later addition at Project site.

* + - * 1. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

Retain first paragraph below if required.

* + - * 1. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

Retain subparagraph below if shoring and reshoring are required.

Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

* + - * 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

Location of construction joints is subject to approval of the Architect.

* + - * 1. Samples: For [**waterstops**] [**vapor retarder**] <**Insert products**>.
      1. INFORMATIONAL SUBMITTALS

Coordinate first paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as supplemented in "Quality Assurance" Article.

* + - * 1. Qualification Data: For [**Installer**] [**manufacturer**] [**testing agency**].

Retain first paragraph below if retaining procedures for welder certification in "Quality Assurance" Article.

* + - * 1. Welding certificates.

Retain first paragraph below for certificates from manufacturers.

* + - * 1. Material Certificates: For each of the following, signed by manufacturers:

Revise list to suit Project.

Cementitious materials.

Admixtures.

Form materials and form-release agents.

Steel reinforcement and accessories.

Fiber reinforcement.

Waterstops.

Curing compounds.

Floor and slab treatments.

Bonding agents.

Adhesives.

Vapor retarders.

Semirigid joint filler.

Joint-filler strips.

Repair materials.

Retain first paragraph below for material test reports that are Contractor's responsibility.

* + - * 1. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

Retain option in subparagraph below if retaining service record data with "Normal-Weight Aggregates" Paragraph in Part 2 "Concrete Materials" Article.

Aggregates.[**Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.**]

Retain first paragraph below if Contractor engages testing agency for measuring floor surface flatness and levelness.

* + - * 1. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

Retain first paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.

Retain paragraph below if preinstallation conference is held.

* + - * 1. Minutes of preinstallation conference.
      1. QUALITY ASSURANCE

Retain first paragraph below if required. See Section 014000 "Quality Requirements" for general installer qualifications. Verify availability of qualified personnel with a local ACI chapter or concrete contractors. These desirable programs may have limited grass-roots penetration.

* + - * 1. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
        2. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

Retain subparagraph below if required.

Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

Retain first paragraph below if Contractor or manufacturer retains testing agency for concrete mixture design, material test reports, or field quality control. Retain option if field quality-control testing agency employed by Contractor must be approved by authorities having jurisdiction.

* + - * 1. Testing Agency Qualifications: An independent agency, [**acceptable to authorities having jurisdiction,**] qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

Retain first subparagraph below, required by ACI 301 and ASTM C 31/C 31M if emphasis is needed. ASTM C 1077 notes relevant field or laboratory technician certification by ACI, NRMCA, and PCA, or the National Institute for Certification in Engineering Technologies may demonstrate evidence of competence.

Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

Retain subparagraph below if requiring minimum qualifications for laboratory personnel performing testing and for laboratory supervisor.

Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

* + - * 1. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article. The American Welding Society (AWS) states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability.

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
        2. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

Retain second option in first subparagraph below if ACI 301, Section 7, for structural lightweight concrete is applicable.

ACI 301, "Specifications for Structural Concrete," [**Sections 1 through 5.**] [**Sections 1 through 5 and Section 7, "Lightweight Concrete."**]

ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

* + - * 1. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

Retain first paragraph below if required. If retaining, indicate location, concrete type, and other details of mockups on Drawings or by inserts. Revise wording if only one mockup is required or if mockup of concrete in another location in a building is required.

* + - * 1. Mockups: Cast concrete [**slab-on-grade**] [**and**] [**formed-surface**] panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

Revise size of panel in first subparagraph below if required. Panel for slab-on-grade may need to be enlarged if powered riding trowels will be used and if it could be a portion of the floor slab.

Build panel approximately [**200 sq. ft. (18.6 sq. m) for slab-on-grade**] [**and**] [**100 sq. ft. (9.3 sq. m) for formed surface**] <**Insert area**> in the location indicated or, if not indicated, as directed by Architect.

Retain subparagraph below if mockups are installed as part of building rather than erected separately and the intention is to make an exception to the default requirement in Section 014000 "Quality Requirements" for demolishing and removing mockups when directed unless otherwise indicated.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

Preinstallation conference, which is desirable for major concrete installations, helps minimize misunderstandings and reviews Project conditions that might lead to significant problems. Retain paragraph below if Work of this Section is extensive or complex enough to justify a preinstallation conference.

* + - * 1. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

Retain first subparagraph below if warranted by complexity of design mixtures and quality control of concrete materials.

Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

Contractor's superintendent.

Independent testing agency responsible for concrete design mixtures.

Ready-mix concrete manufacturer.

Concrete subcontractor.

Retain first subparagraph below if special concrete finishes are included in Project.

Special concrete finish subcontractor.

Review [**special inspection and testing and inspecting agency procedures for field quality control,**] [**concrete finishes and finishing**,] [**cold- and hot-weather concreting procedures,**] [**curing procedures,**] [**construction contraction and isolation joints, and joint-filler strips,**] [**semirigid joint fillers,**] [**forms and form removal limitations,**] [**shoring and reshoring procedures,**] [**vapor-retarder installation,**] [**anchor rod and anchorage device installation tolerances,**] [**steel reinforcement installation,**] [**floor and slab flatness and levelness measurement,**] [**concrete repair procedures,**] and concrete protection.

* + - 1. DELIVERY, STORAGE, AND HANDLING

Retain option in first paragraph below if zinc- or epoxy-coated steel reinforcement is required.

* + - * 1. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.[**Avoid damaging coatings on steel reinforcement.**]
        2. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1. PRODUCTS
   * + 1. FORM-FACING MATERIALS
          1. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

Retain first subparagraph below if generic specification is sufficient; revise to suit Project.

Plywood, metal, or other approved panel materials.

Retain subparagraph below if plywood selection is required. If Finnish overlaid birch plywood is required, insert below and delete DOC PS 1 and other four choices of plywood.

Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

Retain one of four subparagraphs below or revise to suit Project. First subparagraph imparts glossy finish, second imparts matte finish, and third and fourth impart coarser-textured finish depending on face-ply characteristics.

High-density overlay, Class 1 or better.

Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

Structural 1, B-B or better; mill oiled and edge sealed.

B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

* + - * 1. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

Forms in first paragraph below leave joint impressions in spiral or straight lines. Limit types of forms if a particular pattern of joint is required. Different release treatments of forms also affect appearance of as-cast surfaces.

* + - * 1. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
        2. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

Retain void forms, sometimes called "carton forms," in first paragraph below if required for expansive soils or block outs.

* + - * 1. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

Retain first paragraph below if chamfering is permitted.

* + - * 1. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch (19 by 19 mm)**, minimum.
        2. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
        3. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

Formulate form-release agent with rust inhibitor for steel form-facing materials.

* + - * 1. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

Revise three subparagraphs below to suit Project; delete if not required.

Furnish units that will leave no corrodible metal closer than **1 inch (25 mm)** to the plane of exposed concrete surface.

Furnish ties that, when removed, will leave holes no larger than **1 inch (25 mm)** in diameter in concrete surface.

Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

* + - 1. STEEL REINFORCEMENT

Revise this article to suit steel reinforcement requirements; delete if not required.

Retain first paragraph below if recycled content is required for LEED Credit MR 4. The U.S. Green Building Council allows a default value of 25 percent to be used for steel, without documentation; higher percentages can be claimed if they are supported by appropriate documentation. The Steel Recycling Institute indicates that reinforcing bars typically have 57.5 percent postconsumer recycled content and 6.5 percent preconsumer recycled content.

* + - * 1. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [**25**] [**60**] <**Insert number**> percent.
        2. Reinforcing Bars: **ASTM A 615/A 615M**, **Grade 60 (Grade 420)**, deformed.

Retain first paragraph below for reinforcement that is welded or if added ductility is sought.

* + - * 1. Low-Alloy-Steel Reinforcing Bars: **ASTM A 706/A 706M**, deformed.

Retain first paragraph below for galvanized-steel reinforcement. Retain type of reinforcement from first set of options and zinc coating class from second set. Class I has at least 50 percent more zinc weight than Class II.

* + - * 1. Galvanized Reinforcing Bars: [**ASTM A 615/A 615M**, **Grade 60 (Grade 420)**] [**ASTM A 706/A 706M**], deformed bars, ASTM A 767/A 767M, [**Class I**] [**Class II**] zinc coated after fabrication and bending.

Retain first paragraph below for epoxy-coated steel reinforcement. Retain type of reinforcement from first set of options and epoxy-coated product from second set. ASTM A 775/A 775M bars are usually epoxy coated before fabrication; ASTM A 934/A 934M bars are epoxy coated after fabrication and should not be field bent or rebent.

* + - * 1. Epoxy-Coated Reinforcing Bars: [**ASTM A 615/A 615M**, **Grade 60 (Grade 420)**] [**ASTM A 706/A 706M**], deformed bars, [**ASTM A 775/A 775M**] [**or**] [**ASTM A 934/A 934M**], epoxy coated, with less than 2 percent damaged coating in each **12-inch (300-mm)** bar length.

Retain first paragraph below for stainless-steel reinforcement. Retain one of two options for reinforcement type.

* + - * 1. Stainless-Steel Reinforcing Bars: ASTM A 955/A 955M, **Grade 60 (Grade 420)**, [**Type 304**] [**Type 316L**], deformed.
        2. Steel Bar Mats: ASTM A 184/A 184M, fabricated from [**ASTM A 615/A 615M**, **Grade 60 (Grade 420)**] [**ASTM A 706/A 706M**], deformed bars, assembled with clips.
        3. Plain-Steel Wire: ASTM A 82/A 82M, [as drawn] [galvanized].
        4. Deformed-Steel Wire: ASTM A 496/A 496M.
        5. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, [as-drawn, plain] [deformed]-steel wire, with less than 2 percent damaged coating in each **12-inch (300-mm)** wire length.
        6. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
        7. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
        8. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.
        9. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, [plain] [deformed] steel.
      1. REINFORCEMENT ACCESSORIES

Insert other products for dowels or dowel sleeves if required. These include circular and rectangular plastic dowel sleeves, square dowels, and plastic-surfaced or reinforced-paper-covered dowels.

* + - * 1. Joint Dowel Bars: ASTM A 615/A 615M, **Grade 60 (Grade 420)**, plain-steel bars, cut true to length with ends square and free of burrs.
        2. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, **Grade 60 (Grade 420)**, plain-steel bars, ASTM A 775/A 775M epoxy coated.
        3. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
        4. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
        5. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

Retain one or more of three subparagraphs below; revise to suit Project.

For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

Insert mechanical splices and connections for steel reinforcement here if required.

* + - 1. CONCRETE MATERIALS
         1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

Retain type and color of portland cement from options in first subparagraph below.

Portland Cement: ASTM C 150, [**Type I**] **[Type II**] [**Type I/II**] [**Type III**] [**Type V**], [**gray**] [**white**]. [**Supplement with the following:**]

Retain supplementary cementing materials from first two subparagraphs below if permitted. Ready-mix concrete manufacturer blends these materials with portland cement. Fly ash, slag, or pozzolanic materials may slow rate of concrete strengthening and affect color uniformity. Availability of Class F fly ash predominates over Class C fly ash.

Fly Ash: ASTM C 618, [**Class F**] [**Class F or C**].

Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

Retain subparagraph below if factory-blended hydraulic cement is permitted; verify availability of options before specifying. Fly ash, slag, or pozzolanic materials in the nonportland cement part of blended hydraulic cement may slow rate of concrete strengthening and affect color uniformity.

Blended Hydraulic Cement: ASTM C 595, [**Type IS, portland blast-furnace slag]** [**Type IP, portland-pozzola**n] [**Type I (PM), pozzolan-modified portland**] **[Type I (SM), slag-modified portland**] cement.

Silica fume in first paragraph below is most often used in high-strength concrete and in special applications such as bridge decks to enhance durability by lowering permeability of concrete. ACI 301 identifies silica fume as a cementitious material.

* + - * 1. Silica Fume: ASTM C 1240, amorphous silica.

Retain class of aggregate from options in first paragraph below or revise to suit Project. ASTM C 33 limits deleterious substances in coarse aggregate depending on climate severity and in-service location of concrete. Classes in first set of options are ASTM C 33 default classes for concrete exposed to weather for Severe, Moderate, and Negligible weathering regions, respectively. Revise first two options to Class 4S or 4M if concrete will be exposed to frequent wetting. Retain last option if damage caused by concrete expansion from alkali silica or alkali carbonate reactions is anticipated.

* + - * 1. Normal-Weight Aggregates: ASTM C 33, [**Class 3S**] [**Class 3M**] [**Class 1N**] <**Insert class**> coarse aggregate or better, graded. Provide aggregates from a single source [**with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials**].

Retain coarse-aggregate size from three options in first subparagraph below; insert gradation requirements if preferred. Aggregate size limits relate to spacing of steel reinforcement, depth of slab, or thickness of concrete member.

Maximum Coarse-Aggregate Size: [**1-1/2 inches (38 mm)**] [**1 inch (25 mm)**] [**3/4 inch (19 mm)**] nominal.

Retain subparagraph below if optional restriction for fine aggregate in ASTM C 33 is required.

Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

Retain first paragraph below if using lightweight aggregate for structural lightweight concrete. Retain size limit from four options below.

* + - * 1. Lightweight Aggregate: ASTM C 330, [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] [**1/2-inch (13-mm)**] [**3/8-inch (10-mm)**] nominal maximum aggregate size.
        2. Water: ASTM C 94/C 94M [**and potable**].
      1. ADMIXTURES
         1. Air-Entraining Admixture: ASTM C 260.
         2. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

Retain one or more chemical admixtures from six subparagraphs below.

Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

Retarding Admixture: ASTM C 494/C 494M, Type B.

Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

Retain first paragraph below if set-accelerating corrosion inhibitors are required. Set-accelerating products are usually calcium nitrite-based admixtures and comply with ASTM C 494/C 494M, Type C.

* + - * 1. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1145&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Axim Italcementi Group, Inc.; CATEXOL CN-CI](http://www.specagent.com/LookUp/?uid=123456816661&mf=04&src=wd).

[BASF Construction Chemicals - Building Systems; Rheocrete CNI](http://www.specagent.com/LookUp/?uid=123456816662&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company](http://www.specagent.com/LookUp/?uid=123456816664&mf=04&src=wd); [**ARRMATECT**] [**EUCON BCN**] [**EUCON CIA**].

[GCP Construction Products, GCP Advancedd Technologies; DCI](http://www.specagent.com/LookUp/?uid=123456816666&mf=04&src=wd).

[Sika Corporation; Sika CNI](http://www.specagent.com/LookUp/?uid=123456816668&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain first paragraph below if corrosion inhibitors that do not affect concrete setting time are required.

* + - * 1. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1146&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[BASF Construction Chemicals - Building Systems; Rheocrete 222+](http://www.specagent.com/LookUp/?uid=123456816670&mf=04&src=wd).

[Cortec Corporation](http://www.specagent.com/LookUp/?uid=123456816671&mf=04&src=wd); MCI- [**2000**] [**2005NS**].

[GCP Construction Products, GCP Advancedd Technologies; DCI-S](http://www.specagent.com/LookUp/?uid=123456816673&mf=04&src=wd).

[Sika Corporation; FerroGard 901](http://www.specagent.com/LookUp/?uid=123456816674&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain paragraph below for integrally colored concrete.

* + - * 1. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable,[**free of carbon black,**] nonfading, and resistant to lime and other alkalis.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain first subparagraph and list of manufacturers below. See Section 016000 "Product Requirements."

[Manufacturers](http://www.specagent.com/LookUp/?ulid=1148&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

[ChemMasters](http://www.specagent.com/LookUp/?uid=123456801525&mf=04&src=wd).

[Davis Colors](http://www.specagent.com/LookUp/?uid=123456801526&mf=04&src=wd).

[Dayton Superior Corporation](http://www.specagent.com/LookUp/?uid=123456801527&mf=04&src=wd).

[Hoover Color Corporation](http://www.specagent.com/LookUp/?uid=123456801528&mf=04&src=wd).

[Lambert Corporation](http://www.specagent.com/LookUp/?uid=123456801529&mf=04&src=wd).

[QC Construction Products](http://www.specagent.com/LookUp/?uid=123456801530&mf=04&src=wd).

[Rockwood Pigments NA, Inc](http://www.specagent.com/LookUp/?uid=123456801531&mf=04&src=wd).

[Scofield, L. M. Company](http://www.specagent.com/LookUp/?uid=123456801532&mf=04&src=wd).

[Solomon Colors, Inc](http://www.specagent.com/LookUp/?uid=123456801533&mf=04&src=wd).

<**Insert manufacturer's name**>.

Retain one of three options in subparagraph below.

Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

Insert other admixtures, such as integral waterproofing admixtures, if required.

* + - 1. FIBER REINFORCEMENT

Retain first paragraph below if using steel-fiber reinforcement. Retain length of fiber from first set of options and the ratio of length to effective diameter from second set of options for aspect ratio.

* + - * 1. Carbon-Steel Fiber: ASTM A 820/A 820M, deformed, minimum of [**1.5 inches (38 mm)**] [**2 inches (50 mm)**] [**2.4 inches (60 mm)**] <Insert dimension> long, and aspect ratio of [**35 to 40**] [**45 to 50**] [**60 to 65**] <**Insert ratio**>.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Fiber: Type 1, Cold-Drawn Wire](http://www.specagent.com/LookUp/?ulid=1149&mf=04&mf=95&src=wd&mf=04&src=wd):

[Bekaert; Dramix](http://www.specagent.com/LookUp/?uid=123456816675&mf=04&src=wd).

[Fibercon International, Inc.; Fibercon Drawn Wire](http://www.specagent.com/LookUp/?uid=123456816679&mf=04&src=wd).

[Nycon, Inc.; Nycon SF Type I](http://www.specagent.com/LookUp/?uid=123456816681&mf=04&src=wd).

[Propex Concrete Systems Corp.; Novocon 1050](http://www.specagent.com/LookUp/?uid=123456816682&mf=04&src=wd).

[Sika Corporation; Sika Fiber SH](http://www.specagent.com/LookUp/?uid=123456816683&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

[Fiber: Type 2, Cut Sheet](http://www.specagent.com/LookUp/?ulid=1151&mf=04&mf=95&src=wd&mf=04&src=wd):

[Bekaert; Wiremix](http://www.specagent.com/LookUp/?uid=123456816684&mf=04&src=wd).

[Fibercon International, Inc.; Fibercon Cut Sheet](http://www.specagent.com/LookUp/?uid=123456816685&mf=04&src=wd).

[Nycon, Inc.; Nycon SF Type II](http://www.specagent.com/LookUp/?uid=123456816688&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain first paragraph below if using synthetic micro-fiber reinforcement. Revise fiber type if inserting polyester or nylon fibers. Monofilament fibers help reduce plastic shrinkage cracking. Manufacturers claim fibrillated fibers also improve hardened concrete properties.

* + - * 1. Synthetic Micro-Fiber: [**Monofilament**] [**or**] [**fibrillated**] polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, [**1/2 to 1-1/2 inches (13 to 38 mm)**] [**1 to 2-1/4 inches (25 to 57 mm)**] <Insert dimensions> long.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

Products: Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Monofilament Micro-Fibers](http://www.specagent.com/LookUp/?ulid=1153&mf=04&mf=95&src=wd&mf=04&src=wd):

[Axim Italcementi Group, Inc.; Fibrasol II P](http://www.specagent.com/LookUp/?uid=123456816696&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company](http://www.specagent.com/LookUp/?uid=123456816697&mf=04&src=wd); Fiberstrand [**100**] [**150**].

[FORTA Corporation; FORTA Econo-Mono](http://www.specagent.com/LookUp/?uid=123456816698&mf=04&src=wd).

[GCP Construction Products, GCP Advancedd Technologies; GCP MicroFiber](http://www.specagent.com/LookUp/?uid=123456816699&mf=04&src=wd).

[Metalcrete Industries; Polystrand 1000](http://www.specagent.com/LookUp/?uid=123456816702&mf=04&src=wd).

[Nycon, Inc.; ProConM](http://www.specagent.com/LookUp/?uid=123456816708&mf=04&src=wd).

[Propex Concrete Systems Corp.; Fibermesh 150](http://www.specagent.com/LookUp/?uid=123456816709&mf=04&src=wd).

[Sika Corporation; Sika Fiber PPM](http://www.specagent.com/LookUp/?uid=123456816710&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

[Fibrillated Micro-Fibers](http://www.specagent.com/LookUp/?ulid=1155&mf=04&mf=95&src=wd&mf=04&src=wd):

[Axim Italcementi Group, Inc.; Fibrasol F](http://www.specagent.com/LookUp/?uid=123456816711&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Fiberstrand F](http://www.specagent.com/LookUp/?uid=123456816712&mf=04&src=wd).

[FORTA Corporation](http://www.specagent.com/LookUp/?uid=123456816713&mf=04&src=wd); FORTA [**Econo-Net**] [Ultra-Net].

[GCP Construction Products, GCP Advancedd Technologies; GCP Fibers](http://www.specagent.com/LookUp/?uid=123456816714&mf=04&src=wd).

[Nycon, Inc.; ProConF](http://www.specagent.com/LookUp/?uid=123456816715&mf=04&src=wd).

[Propex Concrete Systems Corp.; Fibermesh 300](http://www.specagent.com/LookUp/?uid=123456816716&mf=04&src=wd).

[Sika Corporation; Sika Fiber PPF](http://www.specagent.com/LookUp/?uid=123456816717&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Manufacturers claim macro-fiber reinforcement can be used for crack control and may substitute for wire mesh and some light steel reinforcement bar configurations in slabs-on-ground and composite slabs. The quantity of fiber required to be inserted into the concrete is calculated by a structural engineer based on criteria furnished by the fiber manufacturer.

* + - * 1. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, [**1 to 2-1/4 inches (25 to 57 mm)**] <**Insert dimensions**> long.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1157&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[3M](http://www.specagent.com/LookUp/?uid=123456816718&mf=04&src=wd); Scotchcast Polyolefin Fibers [**1"**] [**2"**].

[Euclid Chemical Company (The), an RPM company; Tuf-Strand SF](http://www.specagent.com/LookUp/?uid=123456816719&mf=04&src=wd).

[FORTA Corporation; FORTA FERRO](http://www.specagent.com/LookUp/?uid=123456816720&mf=04&src=wd).

[GCP Construction Products, GCP Advancedd Technologies; Strux 90/40](http://www.specagent.com/LookUp/?uid=123456816721&mf=04&src=wd).

[Nycon, Inc.; XL](http://www.specagent.com/LookUp/?uid=123456816722&mf=04&src=wd).

[Propex Concrete Systems Corp.; Fibermesh 650](http://www.specagent.com/LookUp/?uid=123456816723&mf=04&src=wd).

[Sika Corporation](http://www.specagent.com/LookUp/?uid=123456816724&mf=04&src=wd); Sika Fiber [**MS**] [**MS10**].

<**Insert manufacturer's name; product name or designation**>.

* + - 1. WATERSTOPS
         1. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular strip, bentonite-free hydrophilic rubber or polyurethane

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1165&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[GCP Construction Products, GCP Advancedd Technologies;](http://www.specagent.com/LookUp/?uid=123456816714&mf=04&src=wd) Adcor ES

GCP Construction Products; DeNeef Swellseal 2010

GCP Construction Products; DeNeef Swellseal 108

GCP Construction Products; DeNeef Swellseal Joint

GCP Construction Products; DeNeef Swellseal 8

<**Insert manufacturer's name; product name or designation**>.

* + - * 1. Injectable Grout Waterstops: Waterstops consisting of a tube and waterproof grout that is injected into the tube to deliver the waterproof grout. Inject the Waterproof Grout into the tube after the concrete has been placed.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1165&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

GCP Construction Products; DeNeef INJECTO® Tube

GCP Construction Products; DeNeef TRIOJECT

<**Insert manufacturer's name; product name or designation**>.

* + - * 1. Self-Expanding Polyurethane Sealant Waterstops: Single component hydrophilic polyurethane sealant for providing a waterstop for smooth to very irregular construction joints and penetrations.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1165&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

GCP Construction Products; DeNeef Swellseal WA

<**Insert manufacturer's name; product name or designation**>.

* + - 1. VAPOR RETARDERS

Retain one sheet vapor retarder from first four paragraphs below if a non-bituminous water vapor retarder is required.

Retain option and insert perm rating in first paragraph below if requiring a stricter perm rating than the 0.3 perms permitted by ASTM E 1745. See Evaluations.

* + - * 1. Sheet Vapor Retarder: ASTM E 1745, Class A, [**except with maximum perm rating of** <**Insert rating**>]. Include manufacturer's recommended adhesive or pressure-sensitive tape.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1166&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Carlisle Coatings & Waterproofing, Inc.; Blackline 400](http://www.specagent.com/LookUp/?uid=123456816737&mf=04&src=wd).

[Fortifiber Building Systems Group](http://www.specagent.com/LookUp/?uid=123456816738&mf=04&src=wd); Moistop Ultra [**15**] [**10**].

[GCP Construction Products, GCP Advancedd Technologies; Florprufe 120](http://www.specagent.com/LookUp/?uid=123456816739&mf=04&src=wd).

[Insulation Solutions, Inc.](http://www.specagent.com/LookUp/?uid=123456816740&mf=04&src=wd); Viper VaporCheck [**16**] [**10**] [**6.5**].

[Meadows, W. R., Inc.](http://www.specagent.com/LookUp/?uid=123456816741&mf=04&src=wd); Perminator [**15 mil**] [**10 mil**].

[Raven Industries Inc.](http://www.specagent.com/LookUp/?uid=123456816742&mf=04&src=wd); Vapor Block [**15**] [**10**].

[Reef Industries, Inc.](http://www.specagent.com/LookUp/?uid=123456816743&mf=04&src=wd); Griffolyn [**Type-105**] [**Type-65G**] [**15 mil Green**] [**10 mil Green**].

[Stego Industries, LLC](http://www.specagent.com/LookUp/?uid=123456816744&mf=04&src=wd); Stego Wrap [**15 mil Class A**] [**10 mil Class A**].

<**Insert manufacturer's name; product name or designation**>.

Retain option and insert perm rating in first paragraph below if requiring a stricter perm rating than the 0.3 perms permitted by ASTM E 1745. See Evaluations.

* + - * 1. Sheet Vapor Retarder: ASTM E 1745, Class B, [**except with maximum perm rating of** <**Insert rating**>]. Include manufacturer's recommended adhesive or pressure-sensitive tape.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1168&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Fortifiber Building Systems Group; Moistop Ultra 6](http://www.specagent.com/LookUp/?uid=123456816745&mf=04&src=wd).

[Raven Industries Inc.](http://www.specagent.com/LookUp/?uid=123456816746&mf=04&src=wd); Griffolyn [**Type-65**] [**10 mil Green**].

[Stego Industries, LLC; Stego Wrap, 10 mil Class A](http://www.specagent.com/LookUp/?uid=123456816747&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain option and insert perm rating in first paragraph below if requiring a stricter perm rating than the 0.3 perms permitted by ASTM E 1745. See Evaluations.

* + - * 1. Sheet Vapor Retarder: ASTM E 1745, Class C, [**except with maximum perm rating of** <**Insert rating**>]. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1169&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Fortifiber Building Systems Group; Moistop Plus](http://www.specagent.com/LookUp/?uid=123456816748&mf=04&src=wd).

[Raven Industries Inc.; Vapor Block 6](http://www.specagent.com/LookUp/?uid=123456816749&mf=04&src=wd).

[Reef Industries, Inc.](http://www.specagent.com/LookUp/?uid=123456816750&mf=04&src=wd); Griffolyn [**Type-65**] [**Type-85**].

[Stego Industries, LLC; Stego Wrap, 10 mil Class C](http://www.specagent.com/LookUp/?uid=123456816751&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain first paragraph below if generic polyethylene, not complying with ASTM E 1745, is permitted.

* + - * 1. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than **10 mils (0.25 mm)** thick.

Retain first paragraph below if bituminous vapor retarder is required.

* + - * 1. Bituminous Vapor Retarder: **110-mil- (2.8-mm-)** thick, semiflexible, 7-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weathercoating, and removable plastic release liner. Furnish manufacturer's accessories including bonding asphalt, pointing mastics, and self-adhering joint tape.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1171&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Meadows, W. R., Inc.; Premoulded Membrane Vapor Seal](http://www.specagent.com/LookUp/?uid=123456816752&mf=04&src=wd).

Water-Vapor Permeance: **0.00 grains/h x sq. ft. x inches Hg (0.00 ng/Pa x s x sq. m)**; ASTM E 154.

Tensile Strength: **140 lbf/inch (24.5 kN/m)**; ASTM E 154.

Puncture Resistance: **90 lbf (400N)**; ASTM E 154.

Retain two paragraphs below if using a granular course over vapor retarder. Products are based on ACI 302.1R descriptions of granular materials.

Retain first paragraph below for a "crusher-run" course at least 4 inches (100 mm) thick.

* + - * 1. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a **1-1/2-inch (37.5-mm)** sieve and 0 to 5 percent passing a **No. 8 (2.36-mm)** sieve.

Retain paragraph below for a fine-graded granular course at least 3 inches (75 mm) thick. This material may also be used as a thin layer over a granular fill course.

* + - * 1. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a **3/8-inch (9.5-mm)** sieve, 10 to 30 percent passing a **No. 100 (0.15-mm)** sieve, and at least 5 percent **passing No. 200 (0.075-mm)** sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.
      1. FLOOR AND SLAB TREATMENTS

Retain this article if one or more floor and slab treatments are required.

* + - * 1. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing [**3/8-inch (9.5-mm)**] [**No. 4 (4.75-mm)**] [**No. 8 (2.36-mm)**] <Insert size or gradation> sieve.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1173&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

[Anti-Hydro International, Inc.; Emery](http://www.specagent.com/LookUp/?uid=123456816753&mf=04&src=wd).

[Dayton Superior Corporation; Emery Tuff Non-Slip](http://www.specagent.com/LookUp/?uid=123456816754&mf=04&src=wd).

[Lambert Corporation; EMAG-20](http://www.specagent.com/LookUp/?uid=123456816755&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Grip It](http://www.specagent.com/LookUp/?uid=123456816756&mf=04&src=wd).

[Metalcrete Industries; Metco Anti-Skid Aggregate](http://www.specagent.com/LookUp/?uid=123456816757&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

* + - * 1. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1174&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Anti-Hydro International, Inc.; A-H Alox](http://www.specagent.com/LookUp/?uid=123456816758&mf=04&src=wd).

[BASF Construction Chemicals - Building Systems; Frictex NS](http://www.specagent.com/LookUp/?uid=123456816759&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Grip It AO](http://www.specagent.com/LookUp/?uid=123456816760&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

* + - * 1. Emery Dry-Shake Floor Hardener: [**Pigmented**] [**Unpigmented**], factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.

Retain one of three options in subparagraph below if retaining "Pigmented" option in paragraph above.

Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

* + - * 1. Metallic Dry-Shake Floor Hardener: [**Pigmented**] [**Unpigmented**], factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.

Retain one of three options in subparagraph below if retaining "Pigmented" option in paragraph above.

Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

Retain first paragraph below if unpigmented mineral dry-shake floor hardeners are required. Verify suitability with manufacturer if air content of concrete exceeds 3 percent.

* + - * 1. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1175&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

Revise list below if products with light-reflective properties or floor-flatness enhancing properties are required.

[BASF Construction Chemicals - Building Systems; Maximent](http://www.specagent.com/LookUp/?uid=123456816761&mf=04&src=wd).

[ChemMasters; ConColor](http://www.specagent.com/LookUp/?uid=123456816762&mf=04&src=wd).

[Conspec by Dayton Superior; Conshake 500](http://www.specagent.com/LookUp/?uid=123456816763&mf=04&src=wd).

[Dayton Superior Corporation; Quartz Tuff](http://www.specagent.com/LookUp/?uid=123456816764&mf=04&src=wd).

[Edoco by Dayton Superior; Burke Non Metallic Floor Hardener 250](http://www.specagent.com/LookUp/?uid=123456816765&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Surflex](http://www.specagent.com/LookUp/?uid=123456816766&mf=04&src=wd).

[Kaufman Products, Inc.; Tycron](http://www.specagent.com/LookUp/?uid=123456816767&mf=04&src=wd).

[Lambert Corporation; Colorhard](http://www.specagent.com/LookUp/?uid=123456816768&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Quartzplate FF](http://www.specagent.com/LookUp/?uid=123456816769&mf=04&src=wd).

[Metalcrete Industries; Floor Quartz](http://www.specagent.com/LookUp/?uid=123456816770&mf=04&src=wd).

[Scofield, L. M. Company; Lithochrome Color Hardener](http://www.specagent.com/LookUp/?uid=123456816771&mf=04&src=wd).

[Symons by Dayton Superior; Hard Top](http://www.specagent.com/LookUp/?uid=123456816772&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain paragraph below if pigmented mineral dry-shake floor hardeners are required. Verify suitability with manufacturer if air content of concrete exceeds 3 percent.

* + - * 1. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1176&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

Revise list below if products with light-reflective properties or floor-flatness enhancing properties are required.

[BASF Construction Chemicals - Building Systems; Mastercron](http://www.specagent.com/LookUp/?uid=123456816773&mf=04&src=wd).

[ChemMasters; ConColor](http://www.specagent.com/LookUp/?uid=123456816774&mf=04&src=wd).

[Conspec by Dayton Superior; Conshake 600 Colortone](http://www.specagent.com/LookUp/?uid=123456816775&mf=04&src=wd).

[Dayton Superior Corporation; Quartz Tuff](http://www.specagent.com/LookUp/?uid=123456816776&mf=04&src=wd).

[Edoco by Dayton Superior; Burke Non Metallic Floor Hardener 200 - 205](http://www.specagent.com/LookUp/?uid=123456816777&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Surflex](http://www.specagent.com/LookUp/?uid=123456816778&mf=04&src=wd).

[Kaufman Products, Inc.; Tycron](http://www.specagent.com/LookUp/?uid=123456816779&mf=04&src=wd).

[Lambert Corporation; Colorhard](http://www.specagent.com/LookUp/?uid=123456816780&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Quartz Plate FF](http://www.specagent.com/LookUp/?uid=123456816781&mf=04&src=wd).

[Metalcrete Industries; Floor Quartz](http://www.specagent.com/LookUp/?uid=123456816782&mf=04&src=wd).

[Scofield, L. M. Company; Lithochrome Color Hardener](http://www.specagent.com/LookUp/?uid=123456816783&mf=04&src=wd).

[Symons by Dayton Superior; Color Hardener](http://www.specagent.com/LookUp/?uid=123456816784&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain one of three options in subparagraph below.

Color: [**As indicated by manufacturer's designation**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

* + - 1. LIQUID FLOOR TREATMENTS

Retain "VOC Content" Paragraph below if required for LEED-NC, LEED-CI, or LEED-CS Credit IEQ 4.3.

* + - * 1. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Penetrating liquid floor treatment in first paragraph below is commonly applied to harden and densify floors of warehouses and distribution facilities, imparting a clear satin sheen to finished floor. Pigmented products may also be available. Although formulations vary, manufacturers claim these nonfluosilicate liquids improve abrasion and chemical resistance and dustproof concrete surface. When approved by manufacturers, these products may be installed over mineral dry-shake floor hardeners or integrally colored concrete.

* + - * 1. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1177&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[ChemMasters; Chemisil Plus](http://www.specagent.com/LookUp/?uid=123456816785&mf=04&src=wd).

[ChemTec Int'l; ChemTec One](http://www.specagent.com/LookUp/?uid=123456816786&mf=04&src=wd).

[Conspec by Dayton Superior; Intraseal](http://www.specagent.com/LookUp/?uid=123456816787&mf=04&src=wd).

[Curecrete Distribution Inc.; Ashford Formula](http://www.specagent.com/LookUp/?uid=123456816788&mf=04&src=wd).

[Dayton Superior Corporation; Day-Chem Sure Hard (J-17)](http://www.specagent.com/LookUp/?uid=123456816789&mf=04&src=wd).

[Edoco by Dayton Superior; Titan Hard](http://www.specagent.com/LookUp/?uid=123456816790&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Euco Diamond Hard](http://www.specagent.com/LookUp/?uid=123456816791&mf=04&src=wd).

[Kaufman Products, Inc.; SureHard](http://www.specagent.com/LookUp/?uid=123456816792&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Seal Hard](http://www.specagent.com/LookUp/?uid=123456816793&mf=04&src=wd).

[Meadows, W. R., Inc.; LIQUI-HARD](http://www.specagent.com/LookUp/?uid=123456816794&mf=04&src=wd).

[Metalcrete Industries; Floorsaver](http://www.specagent.com/LookUp/?uid=123456816795&mf=04&src=wd).

[Nox-Crete Products Group; Duro-Nox](http://www.specagent.com/LookUp/?uid=123456816796&mf=04&src=wd).

[Symons by Dayton Superior; Buff Hard](http://www.specagent.com/LookUp/?uid=123456816797&mf=04&src=wd).

[US SPEC, Division of US Mix Products Company; US SPEC Industraseal](http://www.specagent.com/LookUp/?uid=123456816798&mf=04&src=wd).

[Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear](http://www.specagent.com/LookUp/?uid=123456816799&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

* + - * 1. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1178&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following] [provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

The liquid floor treatment products in subparagraphs below are specific to proprietary polished concrete floor systems. Retain one or more of these products if specifying the floor polishing systems.

[Advanced Floor Products; Retro-Plate 99](http://www.specagent.com/LookUp/?uid=123456816800&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; FGS Hardener Plus](http://www.specagent.com/LookUp/?uid=123456816801&mf=04&src=wd).

[QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application](http://www.specagent.com/LookUp/?uid=123456816802&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

* + - 1. CURING MATERIALS

Evaporation retarder in first paragraph below temporarily reduces moisture loss from concrete surfaces awaiting finishing in hot, dry, and windy conditions. Evaporation retarders are not curing compounds.

* + - * 1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1180&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Axim Italcementi Group, Inc.; CATEXOL CimFilm](http://www.specagent.com/LookUp/?uid=123456816803&mf=04&src=wd).

[BASF Construction Chemicals - Building Systems; Confilm](http://www.specagent.com/LookUp/?uid=123456816804&mf=04&src=wd).

[ChemMasters; SprayFilm](http://www.specagent.com/LookUp/?uid=123456816805&mf=04&src=wd).

[Conspec by Dayton Superior; Aquafilm](http://www.specagent.com/LookUp/?uid=123456816806&mf=04&src=wd).

[Dayton Superior Corporation; Sure Film (J-74)](http://www.specagent.com/LookUp/?uid=123456816807&mf=04&src=wd).

[Edoco by Dayton Superior; BurkeFilm](http://www.specagent.com/LookUp/?uid=123456816808&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Eucobar](http://www.specagent.com/LookUp/?uid=123456816809&mf=04&src=wd).

[Kaufman Products, Inc.; Vapor-Aid](http://www.specagent.com/LookUp/?uid=123456816810&mf=04&src=wd).

[Lambert Corporation; LAMBCO Skin](http://www.specagent.com/LookUp/?uid=123456816811&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; E-CON](http://www.specagent.com/LookUp/?uid=123456816812&mf=04&src=wd).

[Meadows, W. R., Inc.; EVAPRE](http://www.specagent.com/LookUp/?uid=123456816813&mf=04&src=wd).

[Metalcrete Industries; Waterhold](http://www.specagent.com/LookUp/?uid=123456816814&mf=04&src=wd).

[Nox-Crete Products Group; MONOFILM](http://www.specagent.com/LookUp/?uid=123456816815&mf=04&src=wd).

[Sika Corporation; SikaFilm](http://www.specagent.com/LookUp/?uid=123456816816&mf=04&src=wd).

[SpecChem, LLC; Spec Film](http://www.specagent.com/LookUp/?uid=123456816817&mf=04&src=wd).

[Symons by Dayton Superior; Finishing Aid](http://www.specagent.com/LookUp/?uid=123456816818&mf=04&src=wd).

[TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM](http://www.specagent.com/LookUp/?uid=123456816819&mf=04&src=wd).

[Unitex; PRO-FILM](http://www.specagent.com/LookUp/?uid=123456816820&mf=04&src=wd).

[Vexcon Chemicals, Inc.; Certi-Vex Envio Set](http://www.specagent.com/LookUp/?uid=123456816821&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain curing aids and materials from remaining paragraphs.

* + - * 1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing **approximately 9 oz./sq. yd. (305 g/sq. m)** when dry.
        2. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
        3. Water: Potable.

Retain first paragraph below if a dissipating-type, waterborne, membrane-forming curing compound is required. Although the EPA mandates maximum VOC emissions of 350 g/L for curing compounds, verify VOC emission limits of authorities having jurisdiction. If slow breakdown of curing membrane could interfere with bonding of floor coverings, retain "Removal" Subparagraph in "Concrete Protecting and Curing" Article in Part 3.

* + - * 1. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1182&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB](http://www.specagent.com/LookUp/?uid=123456816822&mf=04&src=wd).

[BASF Construction Chemicals - Building Systems; Kure 200](http://www.specagent.com/LookUp/?uid=123456816823&mf=04&src=wd).

[ChemMasters; Safe-Cure Clear](http://www.specagent.com/LookUp/?uid=123456816824&mf=04&src=wd).

[Conspec by Dayton Superior; W.B. Resin Cure](http://www.specagent.com/LookUp/?uid=123456816825&mf=04&src=wd).

[Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W)](http://www.specagent.com/LookUp/?uid=123456816826&mf=04&src=wd).

[Edoco by Dayton Superior; Res X Cure WB](http://www.specagent.com/LookUp/?uid=123456816827&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C](http://www.specagent.com/LookUp/?uid=123456816828&mf=04&src=wd).

[Kaufman Products, Inc.; Thinfilm 420](http://www.specagent.com/LookUp/?uid=123456816829&mf=04&src=wd).

[Lambert Corporation; AQUA KURE - CLEAR](http://www.specagent.com/LookUp/?uid=123456816830&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; L&M Cure R](http://www.specagent.com/LookUp/?uid=123456816831&mf=04&src=wd).

[Meadows, W. R., Inc.; 1100-CLEAR](http://www.specagent.com/LookUp/?uid=123456816832&mf=04&src=wd).

[Nox-Crete Products Group; Resin Cure E](http://www.specagent.com/LookUp/?uid=123456816833&mf=04&src=wd).

[Right Pointe; Clear Water Resin](http://www.specagent.com/LookUp/?uid=123456816834&mf=04&src=wd).

[SpecChem, LLC; Spec Rez Clear](http://www.specagent.com/LookUp/?uid=123456816835&mf=04&src=wd).

[Symons by Dayton Superior; Resi-Chem Clear](http://www.specagent.com/LookUp/?uid=123456816836&mf=04&src=wd).

[TK Products, Division of Sierra Corporation; TK-2519 DC WB](http://www.specagent.com/LookUp/?uid=123456816837&mf=04&src=wd).

[Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100](http://www.specagent.com/LookUp/?uid=123456816838&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain first paragraph below if a nondissipating-type, waterborne, membrane-forming curing compound with minimal solids content is required. Although the EPA mandates maximum VOC emissions of 350 g/L for curing compounds, verify VOC emission limits of authorities having jurisdiction. Retain option if applicable.

* + - * 1. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating[, certified by curing compound manufacturer to not interfere with bonding of floor covering].

Verify with manufacturer that retained products have been tested against interference with bonding of floor covering.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1184&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[Anti-Hydro International, Inc.; AH Clear Cure WB](http://www.specagent.com/LookUp/?uid=123456816839&mf=04&src=wd).

[BASF Construction Chemicals - Building Systems; Kure-N-Seal WB](http://www.specagent.com/LookUp/?uid=123456816840&mf=04&src=wd).

[ChemMasters; Safe-Cure & Seal 20](http://www.specagent.com/LookUp/?uid=123456816841&mf=04&src=wd).

[Conspec by Dayton Superior; Cure and Seal WB](http://www.specagent.com/LookUp/?uid=123456816842&mf=04&src=wd).

[Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal](http://www.specagent.com/LookUp/?uid=123456816843&mf=04&src=wd).

[Dayton Superior Corporation; Safe Cure and Seal (J-18)](http://www.specagent.com/LookUp/?uid=123456816844&mf=04&src=wd).

[Edoco by Dayton Superior; Spartan Cote WB II](http://www.specagent.com/LookUp/?uid=123456816845&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150](http://www.specagent.com/LookUp/?uid=123456816846&mf=04&src=wd).

[Kaufman Products, Inc.; Cure & Seal 309 Emulsion](http://www.specagent.com/LookUp/?uid=123456816847&mf=04&src=wd).

[Lambert Corporation; Glazecote Sealer-20](http://www.specagent.com/LookUp/?uid=123456816848&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Dress & Seal WB](http://www.specagent.com/LookUp/?uid=123456816849&mf=04&src=wd).

[Meadows, W. R., Inc.; Vocomp-20](http://www.specagent.com/LookUp/?uid=123456816850&mf=04&src=wd).

[Metalcrete Industries; Metcure](http://www.specagent.com/LookUp/?uid=123456816851&mf=04&src=wd).

[Nox-Crete Products Group; Cure & Seal 150E](http://www.specagent.com/LookUp/?uid=123456816852&mf=04&src=wd).

[Symons by Dayton Superior; Cure & Seal 18 Percent E](http://www.specagent.com/LookUp/?uid=123456816853&mf=04&src=wd).

[TK Products, Division of Sierra Corporation; TK-2519 WB](http://www.specagent.com/LookUp/?uid=123456816854&mf=04&src=wd).

[Vexcon Chemicals, Inc.; Starseal 309](http://www.specagent.com/LookUp/?uid=123456816855&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain first paragraph below if a nondissipating-type, waterborne, membrane-forming curing compound with a higher solids content is required. This product will partially seal the concrete. Although the EPA mandates maximum VOC emissions of 350 g/L for curing compounds, verify VOC emission limits of authorities having jurisdiction. Retain option if applicable.

* + - * 1. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating[, certified by curing compound manufacturer to not interfere with bonding of floor covering].

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1186&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[BASF Construction Chemicals - Building Systems; Kure-N-Seal W](http://www.specagent.com/LookUp/?uid=123456816856&mf=04&src=wd).

[ChemMasters; Safe-Cure Clear](http://www.specagent.com/LookUp/?uid=123456816857&mf=04&src=wd).

[Conspec by Dayton Superior; High Seal](http://www.specagent.com/LookUp/?uid=123456816858&mf=04&src=wd).

[Dayton Superior Corporation; Safe Cure and Seal (J-19)](http://www.specagent.com/LookUp/?uid=123456816859&mf=04&src=wd).

[Edoco by Dayton Superior; Spartan Cote WB II 20 Percent](http://www.specagent.com/LookUp/?uid=123456816860&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Diamond Clear VOX; Clearseal WB STD](http://www.specagent.com/LookUp/?uid=123456816861&mf=04&src=wd).

[Kaufman Products, Inc.; SureCure Emulsion](http://www.specagent.com/LookUp/?uid=123456816862&mf=04&src=wd).

[Lambert Corporation; Glazecote Sealer-20](http://www.specagent.com/LookUp/?uid=123456816863&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Dress & Seal WB](http://www.specagent.com/LookUp/?uid=123456816864&mf=04&src=wd).

[Meadows, W. R., Inc.; Vocomp-20](http://www.specagent.com/LookUp/?uid=123456816865&mf=04&src=wd).

[Metalcrete Industries; Metcure 0800](http://www.specagent.com/LookUp/?uid=123456816866&mf=04&src=wd).

[Nox-Crete Products Group; Cure & Seal 200E](http://www.specagent.com/LookUp/?uid=123456816867&mf=04&src=wd).

[Symons by Dayton Superior; Cure & Seal 18 Percent E](http://www.specagent.com/LookUp/?uid=123456816868&mf=04&src=wd).

[Vexcon Chemicals, Inc.; Starseal 0800](http://www.specagent.com/LookUp/?uid=123456816869&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain first paragraph below if a clear, nonyellowing, solvent-borne, membrane-forming curing and sealing compound is required. Although the EPA mandates maximum VOC emissions of 700 g/L for curing and sealing compounds, verify VOC emission limits of authorities having jurisdiction.

* + - * 1. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1187&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[BASF Construction Chemicals - Building Systems; Kure-N-Seal 25 LV](http://www.specagent.com/LookUp/?uid=123456816870&mf=04&src=wd).

[ChemMasters; Spray-Cure & Seal Plus](http://www.specagent.com/LookUp/?uid=123456816871&mf=04&src=wd).

[Conspec by Dayton Superior; Sealcure 1315](http://www.specagent.com/LookUp/?uid=123456816872&mf=04&src=wd).

[Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV)](http://www.specagent.com/LookUp/?uid=123456816873&mf=04&src=wd).

[Edoco by Dayton Superior; Cureseal 1315](http://www.specagent.com/LookUp/?uid=123456816874&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Super Diamond Clear; LusterSeal 300](http://www.specagent.com/LookUp/?uid=123456816875&mf=04&src=wd).

[Kaufman Products, Inc.; Sure Cure 25](http://www.specagent.com/LookUp/?uid=123456816876&mf=04&src=wd).

[Lambert Corporation; UV Super Seal](http://www.specagent.com/LookUp/?uid=123456816877&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Lumiseal Plus](http://www.specagent.com/LookUp/?uid=123456816878&mf=04&src=wd).

[Meadows, W. R., Inc.; CS-309/30](http://www.specagent.com/LookUp/?uid=123456816879&mf=04&src=wd).

[Metalcrete Industries; Seal N Kure 30](http://www.specagent.com/LookUp/?uid=123456816880&mf=04&src=wd).

[Right Pointe; Right Sheen 30](http://www.specagent.com/LookUp/?uid=123456816881&mf=04&src=wd).

[Vexcon Chemicals, Inc.; Certi-Vex AC 1315](http://www.specagent.com/LookUp/?uid=123456816882&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain "VOC Content" Subparagraph below if required for LEED-NC, LEED-CI, or LEED-CS Credit IEQ 4.3.

VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Retain paragraph below if a clear, nonyellowing, waterborne, membrane-forming curing and sealing compound is required. Although the EPA mandates maximum VOC emissions of 700 g/L for curing and sealing compounds, verify VOC emission limits of authorities having jurisdiction.

* + - * 1. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

[Products](http://www.specagent.com/LookUp/?ulid=1189&mf=04&mf=95&src=wd&mf=04&src=wd): Subject to compliance with requirements, [**provide the following**] [**provide one of the following**] [**available products that may be incorporated into the Work include, but are not limited to, the following**]:

[BASF Construction Chemicals - Building Systems; Kure 1315](http://www.specagent.com/LookUp/?uid=123456816883&mf=04&src=wd).

[ChemMasters; Polyseal WB](http://www.specagent.com/LookUp/?uid=123456816884&mf=04&src=wd).

[Conspec by Dayton Superior; Sealcure 1315 WB](http://www.specagent.com/LookUp/?uid=123456816885&mf=04&src=wd).

[Edoco by Dayton Superior; Cureseal 1315 WB](http://www.specagent.com/LookUp/?uid=123456816886&mf=04&src=wd).

[Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300](http://www.specagent.com/LookUp/?uid=123456816887&mf=04&src=wd).

[Kaufman Products, Inc.; Sure Cure 25 Emulsion](http://www.specagent.com/LookUp/?uid=123456816888&mf=04&src=wd).

[Lambert Corporation; UV Safe Seal](http://www.specagent.com/LookUp/?uid=123456816889&mf=04&src=wd).

[L&M Construction Chemicals, Inc.; Lumiseal WB Plus](http://www.specagent.com/LookUp/?uid=123456816890&mf=04&src=wd).

[Meadows, W. R., Inc.; Vocomp-30](http://www.specagent.com/LookUp/?uid=123456816891&mf=04&src=wd).

[Metalcrete Industries; Metcure 30](http://www.specagent.com/LookUp/?uid=123456816892&mf=04&src=wd).

[Right Pointe; Right Sheen WB30](http://www.specagent.com/LookUp/?uid=123456816893&mf=04&src=wd).

[Symons by Dayton Superior; Cure & Seal 31 Percent E](http://www.specagent.com/LookUp/?uid=123456816894&mf=04&src=wd).

[Vexcon Chemicals, Inc.; Vexcon Starseal 1315](http://www.specagent.com/LookUp/?uid=123456816895&mf=04&src=wd).

<**Insert manufacturer's name; product name or designation**>.

Retain "VOC Content" Subparagraph below if required for LEED-NC, LEED-CI, or LEED-CS Credit IEQ 4.3.

VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

* + - 1. RELATED MATERIALS

Retain one or all options in first paragraph below. Joint-filler strips are used in floor isolation joints.

* + - * 1. Expansion- and Isolation-Joint-Filler Strips: [**ASTM D 1751, asphalt-saturated cellulosic fiber**] [**or**] [**ASTM D 1752, cork or self-expanding cork**].

Retain one of two options in first paragraph below if semirigid joint filler is required to fill joints and support edges of trafficked contraction and construction joints.

* + - * 1. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, [**epoxy resin with a Type A shore durometer hardness of 80**] [**aromatic polyurea with a Type A shore durometer hardness range of 90 to 95**] per ASTM D 2240.

Bonding agent in first paragraph below may be used directly from container or as an admixture in cement or sand-cement slurries and rubbing grout.

* + - * 1. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
        2. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

Retain types from two options in subparagraph below based on service loadings.

[**Types I and II, non-load bearing**] [**Types IV and V, load bearing**], for bonding hardened or freshly mixed concrete to hardened concrete.

Retain first paragraph below if reglets are not specified elsewhere. Coordinate product requirements with Section 076200 "Sheet Metal Flashing and Trim" or Section 077100 "Roof Specialties" or in other Sections where reglets are supplied as auxiliary products with waterproofing or roofing membrane flashings.

* + - * 1. Reglets: Fabricate reglets of not less than **0.022-inch- (0.55-mm-)** thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
        2. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than **0.034 inch (0.85 mm)** thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
      1. REPAIR MATERIALS

Retain first paragraph below as a repair material for floor and slab areas beneath floor coverings.

* + - * 1. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/8 inch (3.2 mm)** and that can be feathered at edges to match adjacent floor elevations.

Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch (3.2 to 6 mm)** or coarse sand as recommended by underlayment manufacturer.

Compressive Strength: Not less than [**4100 psi (29 MPa)**] <Insert strength> at 28 days when tested according to ASTM C 109/C 109M.

Retain paragraph below as a repair material for floor or slab areas remaining exposed and not receiving floor coverings. Typical self-leveling floor toppings or overlayment products include "Level Topping" by Dayton Superior, "Levelex HS" by L&M Construction, "Concrete Top" by Symons, and "Certi-Vex SLU TC" by Vexcon. Similar products that exceed 5000 psi (34.5 MPa) include "Ardex K500" by Ardex Engineered Cements and "Mastertop Topping 112" by BASF Construction Chemicals.

* + - * 1. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses **from 1/4 inch (6.4 mm)** and that can be filled in over a scarified surface to match adjacent floor elevations.

Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

Aggregate: Well-graded, washed gravel**, 1/8 to 1/4 inch (3.2 to 6 mm)** or coarse sand as recommended by topping manufacturer.

Compressive Strength: Not less than [**5000 psi (34.5 MPa)**] <Insert strength> at 28 days when tested according to ASTM C 109/C 109M.

* + - 1. CONCRETE MIXTURES, GENERAL
         1. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

Retain first option in first paragraph below if required for LEED Credit ID 1.1. This credit can be achieved by replacing at least 40 percent of the portland cement, which would otherwise be used in concrete, with other cementitious materials. Retain second option if limiting percentage of cementitious materials that can replace portland cement. Neither ACI 301 nor ACI 318 (ACI 318M) limit amount of cementitious materials that can replace portland cement unless concrete is exposed to deicing chemicals. Identify parts of building or structure affected by these limits unless extending them to all concrete.

* + - * 1. Cementitious Materials: [**Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.**] [**Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:**]

Percentages in subparagraphs below repeat ACI 301 limits for concrete exposed to deicing chemicals. Revise to suit Project.

Fly Ash: 25 percent.

Combined Fly Ash and Pozzolan: 25 percent.

Ground Granulated Blast-Furnace Slag: 50 percent.

Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

Retain three subparagraphs below if silica fume is permitted. Limits of silica fume alone or in combination with other cementitious materials below are based on ACI 301 and ACI 318 (ACI 318M).

Silica Fume: 10 percent.

Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

Retain appropriate option in first paragraph below for chloride limits. Identify portions of building with different limits if required. Percentages below repeat ACI 301 limits, respectively, for prestressed (post-tensioned) concrete, reinforced concrete exposed to chloride, reinforced concrete that will not be dry or protected from moisture, and reinforced concrete that will be dry or protected from moisture. ACI 301 and ACI 318 (ACI 318M) express this percentage by weight of cement, not cementitious material.

* + - * 1. Limit water-soluble, chloride-ion content in hardened concrete to [**0.06**] [**0.15**] [**0.30**] [**1.00**] percent by weight of cement.
        2. Admixtures: Use admixtures according to manufacturer's written instructions.

Revise four subparagraphs below to suit Project; delete if not required.

Use [water-reducing] [high-range water-reducing] [or] [plasticizing] admixture in concrete, as required, for placement and workability.

Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

Insert locations and dosage of corrosion-inhibiting admixture to subparagraph below if required.

Use corrosion-inhibiting admixture in concrete mixtures where indicated.

Retain paragraph below if integrally colored concrete is required, and indicate locations here or on Drawings.

* + - * 1. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
      1. CONCRETE MIXTURES FOR BUILDING ELEMENTS

This article contains examples of building elements that often need different concrete mixtures. Revise, consolidate, or add other building elements if more concrete mixtures are required.

Consider inserting minimum cementitious material content for mix designs.

* + - * 1. Footings: Proportion normal-weight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project. Coordinate compressive strength with water-cementitious materials ratio if concrete will be subject to special exposure conditions or sulfate exposure as identified in ACI 318 (ACI 318M).

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [3000 psi (20.7 MPa)] <**Insert strength**> at 28 days.

Retain water-cementitious materials ratio from three options in first subparagraph below, revise to suit Project, or delete if in-service durability conditions are benign and limits on water-cementitious materials ratio are not required. Coordinate water-cementitious materials ratio with compressive strength. See Evaluations for discussion.

Maximum Water-Cementitious Materials Ratio: [**0.50**] [**0.45**] [**0.40**] <Insert ratio>.

Retain slump limit from three options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**] [**8 inches (200 mm)** for concrete with verified slump of **2 to 4 inches (50 to 100 mm)** before adding high-range water-reducing admixture or plasticizing admixture] <**Insert dimension**>, plus or minus **1 inch (25 mm)**.

Retain one or both of two subparagraphs below. Percentages in options are default air contents required by ACI 301 for severe exposure.

Air Content: [**5.5**] <**Insert number**> percent, plus or minus 1.5 percent at point of delivery for **1-1/2-inch (38-mm)** nominal maximum aggregate size.

Air Content: [**6**] <**Insert number**> percent, plus or minus 1.5 percent at point of delivery for [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] nominal maximum aggregate size.

* + - * 1. Foundation Walls: Proportion normal-weight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project. Coordinate compressive strength with water-cementitious materials ratio if concrete will be subject to special exposure conditions or sulfate exposure as identified in ACI 318 (ACI 318M).

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert strength**> at 28 days.

Retain water-cementitious materials ratio from three options in first subparagraph below, revise to suit Project, or delete if in-service durability conditions are benign and limits on water-cementitious materials ratio are not required. Coordinate water-cementitious materials ratio with compressive strength. See Evaluations for discussion.

Maximum Water-Cementitious Materials Ratio: [**0.50**] [**0.45**] [**0.40**] <**Insert ratio**>.

Retain slump limit from three options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**] [**8 inches (200 mm)** for concrete with verified slump of **2 to 4 inches (50 to 100 mm)** before adding high-range water-reducing admixture or plasticizing admixture] <**Insert dimension**>, plus or minus **1 inch (25 mm)**.

Retain one or both of two subparagraphs below. Percentages in options are default air contents required by ACI 301 for severe exposure.

Air Content: [**5.5**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for **1-1/2-inch (38-mm)** nominal maximum aggregate size.

Air Content: [**6**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] nominal maximum aggregate size.

* + - * 1. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project.

Minimum Compressive Strength: [**5000 psi (34.5 MPa)]** [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert strength**> at 28 days.

Retain one of three options in first subparagraph below or revise to suit Project. Options are based on minimum requirements set by ACI 301 for floors and relate to nominal maximum aggregate sizes 1-1/2 inches, 1 inch, and 3/4 inch (38, 25, and 19 mm), respectively.

Minimum Cementitious Materials Content: [**470 lb/cu. yd. (279 kg/cu. m)**] [**520 lb/cu. yd. (309 kg/cu. m)**] [**540 lb/cu. yd. (320 kg/cu. m)**].

Retain slump limit from two options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**], plus or minus **1 inch (25 mm)**.

Retain one or more of first three subparagraphs below. Percentages in options in first two subparagraphs are default air contents required by ACI 301 for severe exposure.

Air Content: [**5.5**] <**Insert number**> percent, plus or minus 1.5 percent at point of delivery for **1-1/2-inch (38-mm)** nominal maximum aggregate size.

Air Content: [**6**] <**Insert number**> percent, plus or minus 1.5 percent at point of delivery for [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] nominal maximum aggregate size.

Air content in first subparagraph below is maximum recommended by ACI 302.1R for trowel-finished floors.

Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

Insert water-cementitious materials ratio here if slab-on-grade is subject to special exposure conditions or injurious sulfate exposure.

Retain first subparagraph below if steel-fiber reinforcement is used. Indicate location, on Drawings, of concrete using steel fiber. Revise application rate to suit Project.

Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of [**50 lb/cu. yd. (29.7 kg/cu. m)**] <**Insert weight**>.

Synthetic-micro-fiber dosage rates in first subparagraph below reflect typical recommendations of manufacturers. Retain first option for minimum dosage of synthetic micro-fiber used for reducing plastic shrinkage cracking. Retain second option or increase dosage for synthetic micro-fiber used for improving hardened concrete properties.

Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**1.0 lb/cu. yd. (0.60 kg/cu. m)**] [**1.5 lb/cu. yd. (0.90 kg/cu. m)**] <**Insert dosage**>.

Synthetic-macro-fiber dosage rates in subparagraph below are examples only; verify minimum dosage rates with manufacturer.

Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**4.0 lb/cu. yd. (2.4 kg/cu. m)**] [**5 lb/cu. yd. (3 kg/cu. m)**] <**Insert dosage**>.

Retain first paragraph below if normal-weight concrete is used. Suspended slabs include formed concrete slabs, post-tensioned concrete slabs, and composite or noncomposite concrete slabs on metal deck, classified by ACI 302.1R as single-course floors or base slabs of two-course floors. If Project has more than one type of suspended slab with different properties, indicate location of each on Drawings.

* + - * 1. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project.

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert strength**> at 28 days.

Retain one of three options in first subparagraph below or revise to suit Project. Options are based on minimum requirements set by ACI 301 for floors and relate to nominal maximum aggregate sizes 1-1/2 inches, 1 inch, and 3/4 inch (38, 25, and 19 mm), respectively.

Minimum Cementitious Materials Content: [**470 lb/cu. yd. (279 kg/cu. m)**] [**520 lb/cu. yd. (309 kg/cu. m)**] [**540 lb/cu. yd. (320 kg/cu. m)**].

Retain slump limit from two options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**], plus or minus **1 inch (25 mm)**.

Retain one or more of first three subparagraphs below. Percentages in options in first two subparagraphs are default air contents required by ACI 301 for severe exposure.

Air Content: [**5.5**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for **1-1/2-inch (38-mm)** nominal maximum aggregate size.

Air Content: [**6**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] nominal maximum aggregate size.

Air content in first subparagraph below is maximum recommended by ACI 302.1R for trowel-finished floors.

Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

Insert water-cementitious materials ratio here if elevated slabs will be subject to special exposure conditions.

Retain first subparagraph below if steel-fiber reinforcement is used. Indicate location, on Drawings, of concrete using steel fiber. Revise application rate to suit Project.

Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of [**50 lb/cu. yd. (29.7 kg/cu. m)**] <**Insert weight**>.

Synthetic-micro-fiber dosage rates in first subparagraph below reflect typical recommendations of manufacturers. Retain first option for minimum dosage of synthetic micro-fiber used for reducing plastic shrinkage cracking. Retain second option or increase dosage for synthetic micro-fiber used for improving hardened concrete properties.

Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**1.0 lb/cu. yd. (0.60 kg/cu. m)**] [**1.5 lb/cu. yd. (0.90 kg/cu. m)**] <**Insert dosage**>.

Synthetic-macro-fiber dosage rates in subparagraph below are examples only; verify minimum dosage rates by structural analysis and with manufacturer.

Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**4.0 lb/cu. yd. (2.4 kg/cu. m)**] [**5 lb/cu. yd. (3 kg/cu. m)**] <**Insert dosage**>.

Retain first paragraph below if normal-weight structural concrete is not used. Coordinate requirements with lightweight aggregate supplier, structural engineer, and, if applicable, UL design limits.

* + - * 1. Suspended Slabs: Proportion structural lightweight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project.

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert strength**> at 28 days.

Retain one of three options in first subparagraph below or revise values or unit weight terminology. "Calculated equilibrium unit weight" is the basis preferred by the Expanded Shale Clay and Slate Institute rather than "maximum air dry unit weight" included in ACI 301 for measuring unit weight.

Calculated Equilibrium Unit Weight: [**115 lb/cu. ft. (1842 kg/cu. m)**] [**110 lb/cu. ft. (1762 kg/cu. m)**] [**105 lb/cu. ft. (1682 kg/cu. m)**], plus or minus **3 lb/cu. ft. (48.1 kg/cu. m)** as determined by ASTM C 567.

Retain slump limit from two options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**], plus or minus **1 inch (25 mm)**.

Retain one or more of first three subparagraphs below. Percentages in first two subparagraphs are default air contents required by ACI 301 for lightweight concrete subject to freezing and thawing, severe weather, or deicer chemicals.

Air Content: 6 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size greater than **3/8 inch (10 mm).**

Air Content: 7 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size **3/8 inch (10 mm)** or less.

Air content in first subparagraph below is maximum recommended by ACI 302.1R for trowel-finished floors.

Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

Retain first subparagraph below if steel-fiber reinforcement is used. Indicate location, on Drawings, of concrete using steel fiber. Revise application rate to suit Project.

Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of [**50 lb/cu. yd. (29.7 kg/cu. m)**] <Insert weight>.

Synthetic-micro-fiber dosage rates in first subparagraph below reflect typical recommendations of manufacturers. Retain first option for minimum dosage of synthetic micro-fiber used for reducing plastic shrinkage cracking. Retain second option or increase dosage for synthetic micro-fiber used for improving hardened concrete properties.

Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**1.0 lb/cu. yd. (0.60 kg/cu. m)**] [**1.5 lb/cu. yd. (0.90 kg/cu. m)**] <**Insert dosage**>.

Synthetic-macro-fiber dosage rates in subparagraph below are examples only; verify minimum dosage rates by structural analysis and with manufacturer.

Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**4.0 lb/cu. yd. (2.4 kg/cu. m)**] [**5 lb/cu. yd. (3 kg/cu. m)**] <**Insert dosage**>.

Retain first paragraph below for concrete toppings or concrete underbeds on a base concrete slab or on structural precast concrete.

* + - * 1. Concrete Toppings: Proportion normal-weight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project.

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert strength**> at 28 days.

Retain one of three options in first subparagraph below or revise to suit Project. Options are based on minimum requirements set by ACI 301 for floors and relate to nominal maximum aggregate sizes 1-1/2 inches, 1 inch, and 3/4 inch (38, 25, and 19 mm), respectively.

Minimum Cementitious Materials Content: [**470 lb/cu. yd. (279 kg/cu. m)**] [**520 lb/cu. yd. (309 kg/cu. m)**] [**540 lb/cu. yd. (320 kg/cu. m)**].

Retain slump limit from two options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**], plus or minus **1 inch (25 mm)**.

Retain one or more of first three subparagraphs below. Percentages in options in first two subparagraphs are default air contents required by ACI 301 for severe exposure.

Air Content: [**5.5**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for **1-1/2-inch (38-mm)** nominal maximum aggregate size.

Air Content: [**6**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] nominal maximum aggregate size.

Air content in first subparagraph below is maximum recommended by ACI 302.1R for trowel-finished toppings.

Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.

Retain first subparagraph below if steel-fiber reinforcement is used. Indicate location, on Drawings, of concrete using steel fiber. Revise application rate to suit Project.

Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of [**50 lb/cu. yd. (29.7 kg/cu. m)**] <**Insert weight**>.

Synthetic-micro-fiber dosage rates in first subparagraph below reflect typical recommendations of manufacturers. Retain first option for minimum dosage of synthetic micro-fiber used for reducing plastic shrinkage cracking. Retain second option or increase dosage for synthetic micro-fiber used for improving hardened concrete properties.

Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**1.0 lb/cu. yd. (0.60 kg/cu. m)**] [**1.5 lb/cu. yd. (0.90 kg/cu. m)**] <**Insert dosage**>.

Synthetic-macro-fiber dosage rates in subparagraph below are examples only; verify minimum dosage rates with manufacturer.

Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than [**4.0 lb/cu. yd. (2.4 kg/cu. m)**] [**5 lb/cu. yd. (3 kg/cu. m)**] <**Insert dosage**>.

* + - * 1. Building Frame Members: Proportion normal-weight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project. Coordinate compressive strength with water-cementitious materials ratio if concrete will be subject to special exposure conditions or sulfate exposure as identified in ACI 318 (ACI 318M).

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert strength**> at 28 days.

Retain water-cementitious materials ratio from three options in first subparagraph below, revise to suit Project, or delete if in-service durability conditions are benign and limits on water-cementitious materials ratio are not required. Coordinate water-cementitious materials ratio with compressive strength. See Evaluations for discussion.

Maximum Water-Cementitious Materials Ratio: [**0.50**] [**0.45**] [**0.40**] <Insert ratio>.

Retain slump limit from three options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**] [**8 inches (200 mm)** for concrete with verified slump of **2 to 4 inches (50 to 100 mm)** before adding high-range water-reducing admixture or plasticizing admixture] <**Insert dimension**>, plus or minus **1 inch (25 mm)**.

Retain one or both of two subparagraphs below. Percentages in options are default air contents required by ACI 301 for severe exposure.

Air Content: [**5.5**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for **1-1/2-inch (38-mm)** nominal maximum aggregate size.

Air Content: [**6**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for [**1-inch (25-mm)**] [**3/4-inch (19-mm)**] nominal maximum aggregate size.

* + - * 1. Building Walls: Proportion normal-weight concrete mixture as follows:

Retain strength from five options in first subparagraph below or revise to suit Project. Coordinate compressive strength with water-cementitious materials ratio if concrete will be subject to special exposure conditions or sulfate exposure as identified in ACI 318 (ACI 318M).

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert strength**> at 28 days.

Retain water-cementitious materials ratio from three options in first subparagraph below, revise to suit Project, or delete if in-service durability conditions are benign and limits on water-cementitious materials ratio are not required. Coordinate water-cementitious materials ratio with compressive strength. See Evaluations for discussion.

Maximum Water-Cementitious Materials Ratio: [**0.50**] [**0.45**] [**0.40**] <**Insert ratio**>.

Retain slump limit from three options in first subparagraph below or revise to suit Project.

Slump Limit: [**4 inches (100 mm)**] [**5 inches (125 mm)**] [**8 inches (200 mm)** for concrete with verified slump of **2 to 4 inches (50 to 100 mm)** before adding high-range water-reducing admixture or plasticizing admixture] <Insert dimension>, plus or minus **1 inch (25 mm)**.

Retain one or both of two subparagraphs below. Percentages in options are default air contents required by ACI 301 for severe exposure.

Air Content: [**5.5**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for **1-1/2-inch (38-mm)** nominal maximum aggregate size.

Air Content: [**6**] <Insert number> percent, plus or minus 1.5 percent at point of delivery for [**1-inch (25-mm)**] [**3/4-inch (19-mm**)] nominal maximum aggregate size.

* + - 1. FABRICATING REINFORCEMENT
         1. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
      2. CONCRETE MIXING

Retain option in first paragraph below if steel or synthetic fibers are required.

* + - * 1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, [**and ASTM C 1116/C 1116M**], and furnish batch ticket information.

When air temperature is between **85 and 90 deg F (30 and 32 deg C),** reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above **90 deg F (32 deg C)**, reduce mixing and delivery time to 60 minutes.

Retain paragraph below if Project-site mixing is permitted. ACI 301 applies measuring, batching, and mixing requirements from ASTM C 94/C 94M to Project-site mixing.

* + - * 1. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

For mixer capacity of **1 cu. yd. (0.76 cu. m)** or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

For mixer capacity larger than **1 cu. yd. (0.76 cu. m)**, increase mixing time by 15 seconds for each additional   
**1 cu. yd. (0.76 cu. m)**.

Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

1. EXECUTION
   * + 1. FORMWORK
          1. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
          2. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
          3. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

Retain surface classes, usually two or more, in two subparagraphs below. See discussion in "Formwork" Article in the Evaluations. Coordinate with rough- and smooth-form finishes in "Finishing Formed Surfaces" Article.

[**Class A, 1/8 inch (3.2 mm)**] <**Insert dimension**> for smooth-formed finished surfaces.

[**Class B, 1/4 inch (6 mm)**] [**Class C, 1/2 inch (13 mm)**] [**Class D, 1 inch (25 mm)**] <Insert dimension> for rough-formed finished surfaces.

* + - * 1. Construct forms tight enough to prevent loss of concrete mortar.
        2. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

Install keyways, reglets, recesses, and the like, for easy removal.

Do not use rust-stained steel form-facing material.

* + - * 1. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
        2. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

Retain one of two options in first paragraph below. ACI 301 requires chamfers unless otherwise specified.

* + - * 1. [Chamfer] [Do not chamfer] exterior corners and edges of permanently exposed concrete.
        2. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
        3. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
        4. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
        5. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
      1. EMBEDDED ITEMS

Specify embedded items and anchorage devices for other work attached to or supported by cast-in-place concrete. Insert specific requirements for installing embedded items, if any, that are part of the Work.

* + - * 1. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

Retain applicable subparagraphs below and insert others if required. Revise to suit Project.

Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

Install dovetail anchor slots in concrete structures as indicated.

* + - 1. REMOVING AND REUSING FORMS

Revise removal time in first paragraph below if required. Period of 24 hours is halved to 12 hours in ACI 347. Commentary in ACI 318 (ACI 318M) recognizes 12 hours for concrete using regular portland cement but advises that this period may be insufficient for concrete using Type II and Type V portland cements or ASTM C 595 blended hydraulic cements, concrete with retarding admixtures, and concrete using ice during mixing.

* + - * 1. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than **50 deg F (10 deg C)** for [**24**] <**Insert number**> hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

Retain option in first subparagraph below if adopting recommendation of ACI 347. ACI 301 requires concrete to reach its specified compressive strength.

Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved[ at least 70 percent of] its 28-day design compressive strength.

Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

* + - * 1. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
        2. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.
      1. SHORES AND RESHORES

Review this article with structural engineer and revise if required.

* + - * 1. Comply with **ACI 318 (ACI 318M)** and ACI 301 for design, installation, and removal of shoring and reshoring.

Do not remove shoring or reshoring until measurement of slab tolerances is complete.

Revise first paragraph below if setting more detailed requirements such as a minimum number of floors.

* + - * 1. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
        2. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.
      1. VAPOR RETARDERS
         1. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

Lap joints **6 inches (150 mm)** and seal with manufacturer's recommended tape.

* + - * 1. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

Retain paragraph below if using a granular course over vapor retarder. ACI Committee 302 recommends concrete be placed directly on vapor retarder when slab will receive moisture-sensitive floor coverings.

* + - * 1. Granular Course: Cover vapor retarder with [granular fill] [fine-graded granular material], moisten, and compact with mechanical equipment to elevation tolerances of plus **0 inch (0 mm)** or **minus 3/4 inch (19 mm)**.

Retain subparagraph below if a thin choking-off layer is needed over granular fill.

Place and compact a **1/2-inch- (13-mm-)** thick layer of fine-graded granular material over granular fill.

* + - 1. STEEL REINFORCEMENT
         1. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

* + - * 1. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
        2. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

Retain subparagraph below if welding is permitted or required.

Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

* + - * 1. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
        2. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

Retain first paragraph below if using epoxy-coated reinforcement.

* + - * 1. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

Retain paragraph below if using zinc-coated reinforcement.

* + - * 1. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.
      1. JOINTS

Coordinate joint types, description, and location with Drawings. Joint types have been consolidated in this article for consistency rather than for strict sequence of installation.

* + - * 1. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

Revise criteria for locating construction joints in first paragraph below to suit Project.

* + - * 1. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

Retain first subparagraph below if keyed joints are used. Keyed joints are used in walls and floors and between walls and slabs or footings. ACI 302.1R recommends limiting keyed joints to lightly trafficked floors because keys may fail and lips may chip after concrete shrinks.

Form keyed joints as indicated. Embed keys at least **1-1/2 inches (38 mm)** into concrete.

Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

Insert spacing of construction joints in first subparagraph below if preferred.

Space vertical joints in walls [as indicated] <Insert spacing>. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

Retain one of two subparagraphs below only if a bonding material is permitted.

Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

Insert spacing of contraction joints here or on Drawings if required. Contraction-joint spacings vary with slab thickness, aggregate size, and slump based on PCA's recommendations. Depth of joint may be varied to suit cutting method or if steel-fiber reinforcement is used. Early-entry saws may cut less than one-fourth of concrete thickness; steel-fiber-reinforced slabs, one-third of concrete thickness.

* + - * 1. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least [one-fourth] <Insert depth> of concrete thickness as follows:

Retain type of joint-forming method from two subparagraphs below or retain both subparagraphs as Contractor's option. Insert joint spacing if not indicated on Drawings.

Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of **1/8 inch (3.2 mm)**. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

Retain subparagraph below if saw cutting is permitted. Description does not distinguish conventional wet- and dry-cut saws from early-entry dry-cut saws. Timing is critical to sawed joints. Early-entry dry-cut saws have been used within one to two hours of finishing concrete. To leave concrete undamaged from sawing, conventional saw cutting must be delayed, usually 4 to 12 hours, but not so long that uncontrolled cracking of concrete could occur.

Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut **1/8-inch- (3.2-mm-)** wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

* + - * 1. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

Retain one or both of first two subparagraphs below. If both are required, indicate location of each on Drawings.

Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

Terminate full-width joint-filler strips not less than **1/2 inch (13 mm)** or more than **1 inch (25 mm)** below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.

Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

Retain paragraph below if doweled contraction or expansion joints are used; revise if precoated dowels are required.

* + - * 1. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
      1. WATERSTOPS

Retain paragraphs below depending on type of waterstop required.

* + - * 1. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
        2. Injectable Grout Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, mechanically fastening into place. Install in longest lengths practicable, up to 25 feet. Inject grout into Injecto Tubes after concrete has been placed and cured for a minimum of 28 days.
        3. Self-Expanding Polyurethane Sealant Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.
      1. CONCRETE PLACEMENT
         1. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

Retain one of first two paragraphs below. ACI 301 permits water to be added to concrete mixture on-site to adjust slump, up to amount allowed in design mixture.

* + - * 1. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
        2. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

Retain subparagraph below if high-range water-reducing admixtures are permitted.

Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

* + - * 1. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches (150 mm)** into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

* + - * 1. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Maintain reinforcement in position on chairs during concrete placement.

Screed slab surfaces with a straightedge and strike off to correct elevations.

Slope surfaces uniformly to drains where required.

Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

* + - * 1. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

When average high and low temperature is expected to fall below **40 deg F (4.4 deg C)** for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

* + - * 1. Hot-Weather Placement: Comply with ACI 301 and as follows:

Maintain concrete temperature below **90 deg F (32 deg C)** at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

* + - 1. FINISHING FORMED SURFACES

Retain types of formed finishes required in this article. Coordinate finishes retained with finish schedule or indicate location of each finish on Drawings.

* + - * 1. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

Apply to concrete surfaces [not exposed to public view] <Insert locations>.

* + - * 1. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

Revise locations in subparagraph below to suit Project. Retain rubbed finish option if additional finishing is required.

Apply to concrete surfaces [exposed to public view,] [to receive a rubbed finish,] [to be covered with a coating or covering material applied directly to concrete] <Insert locations>.

Retain rubbed finish in first paragraph below with smooth-formed finish in paragraph above.

* + - * 1. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

Retain one or more rubbed finishes from three subparagraphs below.

Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

* + - * 1. 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. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
      1. FINISHING FLOORS AND SLABS
         1. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

Retain types of slab finishes required from remaining paragraphs. Coordinate finishes retained with finish schedule or indicate location of each finish on Drawings.

* + - * 1. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of **1/4 inch (6 mm)** in one direction.

Revise locations of scratch finish in subparagraph below to suit Project.

Apply scratch finish to surfaces [indicated] [and] [to receive concrete floor toppings] [to receive mortar setting beds for bonded cementitious floor finishes] <Insert locations>.

* + - * 1. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

Revise locations of float finish in subparagraph below to suit Project.

Apply float finish to surfaces [indicated] [to receive trowel finish] [and] [to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo] <Insert locations>.

* + - * 1. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

Revise locations of trowel finish in first subparagraph below to suit Project.

Apply a trowel finish to surfaces [indicated] [exposed to view] [or] [to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system] <Insert locations>.

Finish surfaces to the following tolerances, according to **ASTM E 1155 (ASTM E 1155M)**, for a randomly trafficked floor surface:

Revise surface plane tolerances to suit Project. See Evaluations for description of F-number system. ACI 301 suggests that all residential floors and nonresidential floors less than 10,000 sq. ft. (929 sq. m) be measured by straightedge method and that other nonresidential floors be measured by F-number system.

Retain floor flatness and levelness values required for Project from first four subparagraphs below, or revise values to suit type of floor. ACI 302.1R suggests values in first subparagraph be used for carpeted slabs; those in second and third, for thin floor coverings; and those in fourth, for very flat floors for high-speed forklifts, air pallets, and ice and roller rinks.

Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

Retain straightedge method in subparagraph below if deleting F-number system above.

Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding,  
**10-ft.- (3.05-m-)** long straightedge resting on two high spots and placed anywhere on the surface does not exceed [**1/4 inch (6 mm)**] [**3/16 inch (4.8 mm)**] [**1/8 inch (3.2 mm)**].

* + - * 1. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces [indicated] [where ceramic or quarry tile is to be installed by either thickset or thin-set method]. While concrete is still plastic, slightly scarify surface with a fine broom.

Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

Retain first paragraph below if applicable. Broom finish is generally used on exterior concrete steps and platforms, ramps, and other surfaces subject to light foot traffic.

* + - * 1. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

Retain first paragraph below if applicable. This finish is generally used on interior and exterior concrete treads, platforms, and ramps subject to moderate foot traffic.

* + - * 1. Slip-Resistive Finish: Before final floating, apply slip-resistive [**aggregate**] [**aluminum granule**] finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

Uniformly spread [**25 lb/100 sq. ft. (12 kg/10 sq. m)**] <**Insert rate**> of dampened slip-resistive [aggregate] [aluminum granules] over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.

Revise float finish in first subparagraph below to trowel finish if required.

After broadcasting and tamping, apply float finish.

After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive [aggregate] [aluminum granules].

Retain paragraph below if dry-shake floor hardener, pigmented or unpigmented, finish is required.

* + - * 1. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

Consult manufacturers and revise rate of application in first subparagraph below if required. This rate is usually recommended for light traffic.

Uniformly apply dry-shake floor hardener at a rate of [**100 lb/100 sq. ft. (49 kg/10 sq. m)**] <Insert rate> unless greater amount is recommended by manufacturer.

Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.

Coordinate selection of curing compounds for compatibility with dry-shake floor hardener and revise lists of manufacturers in Part 2 accordingly if required.

After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

* + - 1. MISCELLANEOUS CONCRETE ITEMS

This article is an example only. Insert, revise, or delete items to suit Project.

* + - * 1. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
        2. 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.
        3. Equipment Bases and Foundations:

Coordinate sizes and locations of concrete bases with actual equipment provided.

Construct concrete bases [**4 inches (100 mm)**] [**6 inches (150 mm)**] [**8 inches (200 mm)**] <**Insert dimension**> high unless otherwise indicated; and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.

Minimum Compressive Strength: [**5000 psi (34.5 MPa)**] [**4500 psi (31 MPa)**] [**4000 psi (27.6 MPa)**] [**3500 psi (24.1 MPa)**] [**3000 psi (20.7 MPa)**] <**Insert value**> at 28 days.

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of concrete base.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.

Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

* + - * 1. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.
      1. CONCRETE PROTECTING AND CURING
         1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

If evaporation rate in first paragraph below is exceeded, ACI 305R states that plastic shrinkage cracking is probable. See manufacturers' literature or ACI 305R for estimated moisture-loss chart relating relative humidity, air and concrete temperature, and wind velocity to rate of evaporation.

* + - * 1. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching **0.2 lb/sq. ft. x h (1 kg/sq. m x h)** before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
        2. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
        3. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
        4. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

Retain one or more curing methods from four subparagraphs below. Delete methods or restrict use of curing methods to specific locations or types of surfaces if required.

Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

Retain first three subparagraphs below as Contractor's options unless not suited for Project.

Water.

Continuous water-fog spray.

Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with **12-inch (300-mm)** lap over adjacent absorptive covers.

Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least **12 inches (300 mm)**, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Retain first three subparagraphs below or revise to suit Project.

Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

Retain first subparagraph below if requiring removal of curing compounds that may interfere with adhesion of floor coverings.

Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer[ unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project].

Curing and sealing compound in subparagraph below is usually for floors and slabs and may act as a permanent surface finish.

Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

* + - 1. LIQUID FLOOR TREATMENTS
         1. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

Some manufacturers state that the penetrating liquid floor treatment also functions as a curing aid. If used as a cure, delete minimum age of concrete in first subparagraph below and revise application method to follow manufacturer's written instructions. Coordinate with "Concrete Protecting and Curing" Article.

Do not apply to concrete that is less than [**three**] [**seven**] [**14**] [**28**] days' old.

Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

Retain first paragraph below if polished concrete finish is required. Verify sequence of operations conform to steps of polishing system. Color dyes or other special finish techniques can be inserted if required.

* + - * 1. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

Machine grind floor surfaces to receive polished finishes level and smooth [and to depth required to reveal aggregate to match approved mockup].

Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.

Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.

Control and dispose of waste products produced by grinding and polishing operations.

Neutralize and clean polished floor surfaces.

Usually delete paragraph below if two coats of curing and sealing compound have already been applied during curing stage. Sealing coat may be used as turnover coat, independent of means of curing, to improve appearance of an exposed concrete floor at end of Project.

* + - * 1. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.
      1. JOINT FILLING

Retain this article if joint filling is required.

* + - * 1. Prepare, clean, and install joint filler according to manufacturer's written instructions.

ACI 302.1R recommends joint filling be deferred as long as possible in concrete floors. Use of polyurea joint fillers may allow joint filling to proceed earlier; verify minimum time period with manufacturer. Typically, up to 30 percent of concrete shrinkage takes place in first month, with 80 to 90 percent during first 12 months. Revise period in subparagraph below if too short or too long. Joints must be filled before industrial floors can be placed in service.

Defer joint filling until concrete has aged at least [**one**] [**six**] month(s). Do not fill joints until construction traffic has permanently ceased.

* + - * 1. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
        2. Install semirigid joint filler full depth in saw-cut joints and at least **2 inches (50 mm)** deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
      1. CONCRETE SURFACE REPAIRS

This article provides basic applications for repairing concrete surfaces. Revise or delete to suit Project.

* + - * 1. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
        2. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a **No. 16 (1.18-mm)** sieve, using only enough water for handling and placing.

Insert provision for testing repair technique on a mockup or surface to be concealed later, before repairing surfaces.

* + - * 1. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

Immediately after form removal, cut out honeycombs, rock pockets, and voids more than **1/2 inch (13 mm)** in any dimension to solid concrete. Limit cut depth to **3/4 inch (19 mm)**. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

* + - * 1. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of **0.01 inch (0.25 mm)** wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

After concrete has cured at least 14 days, correct high areas by grinding.

Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

Retain one or both of first two subparagraphs below if applicable. First subparagraph uses an underlayment; second, a topping.

Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of **1/4 inch (6 mm)** to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

Repair defective areas, except random cracks and single holes **1 inch (25 mm)** or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair random cracks and single holes **1 inch (25 mm)** or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

* + - * 1. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
        2. Repair materials and installation not specified above may be used, subject to Architect's approval.
      1. FIELD QUALITY CONTROL

Retain one of first two paragraphs below.

Retain first option in first paragraph below if authorities having jurisdiction require Owner to engage a special inspector. Retain last option if Owner engages testing agency, with or without a special inspector. See "Testing and Inspecting Considerations" Article in the Evaluations.

* + - * 1. Testing and Inspecting: Owner will engage a [special inspector] [and] [qualified testing and inspecting agency] to perform field tests and inspections and prepare test reports.

Retain first paragraph below if Contractor engages testing agency.

* + - * 1. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to   
           submit reports.
        2. Inspections:

Retain seven subparagraphs below if special inspections are required. Items below are examples of special inspections and are based on IBC requirements; revise to insert other inspections or to suit requirements of other building codes.

Steel reinforcement placement.

Steel reinforcement welding.

Headed bolts and studs.

Verification of use of required design mixture.

Concrete placement, including conveying and depositing.

Curing procedures and maintenance of curing temperature.

Verification of concrete strength before removal of shores and forms from beams and slabs.

* + - * 1. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

Retain one of first two subparagraphs below. First subparagraph is an example that produces more frequent testing than second subparagraph, which is the minimum required to comply with ACI 301.

Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding **5 cu. yd. (4 cu. m)**, but less than **25 cu. yd. (19 cu. m)**, plus one set for each additional **50 cu. yd. (38 cu. m)** or fraction thereof.

Testing Frequency: Obtain at least one composite sample for each **100 cu. yd. (76 cu. m)** or fraction thereof of each concrete mixture placed each day.

Retain first subparagraph below with either subparagraph retained above.

When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

Air Content: ASTM C 231, pressure method, for normal-weight concrete; [ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; ]one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is **40 deg F (4.4 deg C)** and below and when **80 deg F (27 deg C)** and above, and one test for each composite sample.

Retain first subparagraph below if structural lightweight concrete is required.

Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

Compression Test Specimens: ASTM C 31/C 31M.

Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

Field-cured specimens in first subparagraph below may be required to verify adequacy of curing and protection of concrete, to verify strength for tilt-up concrete and post-tensioning concrete, or to verify strength for removal of shoring and reshoring in multistory construction. Revise number of test specimens if required.

Cast and field cure [two] <Insert number> sets of two standard cylinder specimens for each composite sample.

Coordinate the number of compression test specimens in subparagraph above with number of compressive-strength tests in first subparagraph below.

Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

Revise age at testing in first subparagraph below or delete if not required. Limit field testing to concrete in designated structural elements if not required throughout Project.

Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

Retain first subparagraph below if field-cured specimens are required.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than **500 psi (3.4 MPa)**.

Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

Retain paragraph below if measurements of floor flatness and levelness tolerances are required.

* + - * 1. Measure floor and slab flatness and levelness according to **ASTM E 1155 (ASTM E 1155M)** within [**24**] [**48**] <Insert number> hours of finishing.
      1. PROTECTION OF LIQUID FLOOR TREATMENTS
         1. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.