

Division 03 | Concrete

Section includes various guidelines for general concrete use, curing, forming, reinforcing, finishing and concrete accessories.

This design guideline is written to the designer of record (DOR). This guideline is written to document UA standards of work, assist the designers in ensuring UA standards are incorporated into the contract documents and provide a resource to facilitate the design process. It is the designer of record's responsibility to coordinate the criteria set forth in these design guidelines and in conjunction with the manufacturer requirements and use the most stringent standard.

A. General

Philosophy and Approach

All concrete shall be designed, transported, placed, finished, and cured in accordance with American Concrete Institute (ACI) requirements. Components of the concrete mix shall meet applicable ANSI/ASTM requirements. Mix requirements and strength shall be specified by the Design Team for each item of construction. Structural drawings to be sealed by a registered structural engineer in the State of Alabama and contain the following:

1. Specify all loads used for design with complete strength calculations
2. Shop drawings required for fabrication, grade, and placement of reinforcement, including joint locations and sealing compounds. Provide certification from (an independent testing laboratory) that mechanical connectors for steel reinforcing comply with applicable codes and engineering calculations.

B. Products

Form Materials

1. Forms for Exposed Finished Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
2. Forms for Unexposed Finished Concrete: Form concrete surfaces which will be exposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
3. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.



Reinforcing Materials

1. Reinforcing Bars: ASTM A615. Grade 60, deformed.
2. Steel Wire: ASTM A82, plain, cold-drawn, steel.
3. Welded Wire Fabric: ASTM A185, welded steel wire fabric.
4. Welded Deformed Steel Wire Fabric: ASTM A497.
5. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI Specifications, unless otherwise approved by UA in advance.

Concrete Materials

1. Portland Cement: ASTM C150, Type I or II low alkali, unless otherwise acceptable to UA.
2. Use one brand of cement throughout project, unless otherwise acceptable to UA.
3. Fly Ash: ASTM C618, Type C or Type F. Limit use fly ash to not exceed 25% of cement content by weight.
4. Normal Weight Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.
 - a. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing or deleterious substances.
 - b. Local aggregates not complying with ASTM C33 but which have shown by special test of actual service to produce concrete of adequate strength and durability may be used when acceptable to UA.
5. Water: Potable
6. Air-Entrainment Admixture: ASTM C260.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - i. “Sika Aer”; Sika Corp.
 - ii. “MB-VR” or “MB-AE”; Master Builders
 - iii. “Dorex AEA”; W.R. Grace
 - iv. “Edoco 2001 or 2002”; Edoco Technical Products

Concrete Accessories

1. Provide plastic expansion joint cap similar to “Snap-Cap”, as manufactured by W.R. Meadows, where concrete walks or paving abuts the exterior wall of buildings.
2. Install expansion joint cap over top of expansion joint and pull out once concrete is cured prior to applying sealant.



C. Mixes and Testing

Proportioning and Design of Mixes

1. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to UA for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to UA.
2. Submit written reports to UA of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by UA.
3. Design Mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedule: 3000 psi 28-day compressive strength; W/C ration, 0.58 maximum (non-air-entrained), .046 maximum (air entrained).
4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content as required.
5. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 - a. Ramps, slabs and sloping surfaces: Not more than 3".
 - b. Reinforced Foundation Systems: Not less than 1" and not more than 3".
 - c. Concrete Containing HRWR Admixture (Super Plasticizer): Not more than 8" after addition of HRWR to verify less than 3" slump concrete.
 - d. Other Concrete: Not more than 4"
6. Testing: UA will employ a testing laboratory to perform tests and to submit test reports. However, UA is not obligated to perform the test for the convenience of the Contractor.
 - a. Preparation of concrete Cylinders: ASTM C31; one (1) set of three (3) for each day's pour exceeding five (5 c.y.) cubic yards, plus additional sets for each additional twenty-five (25 c.y.) cubic yards of each concrete class places in any one (1) day.
 - b. Compressive Strength Tests: ASTM C39; one (1) specimen tested at seven (7) days, one (1) specimen tested at twenty-eight (28) days, and one (1) specimen retained in reserve for later testing if required.

Concrete Mixes

1. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as herein specified.
 - a. Air Temperature: Maximum allowable combined mixing, delivery, and placement time
 - b. Less than 85 degrees: Per ASTM C94 unless a shorter time is necessary due to the job conditions, but 1 ½ hours maximum.
 - c. 85 degrees – 90 degrees F: 75 minutes



- d. Greater than 90 degrees F: 60 minutes

D. Concrete Formwork

1. Formwork to be designed by a professional engineer registered in the State of Alabama. Material should have sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances. Provide chamfered edges and corners at exposed locations.
 - a. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structures. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
 - b. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
 - c. Form Ties: Factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
2. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is 1" inside concrete and will not leave holes larger than 1" diameter in concrete surface.

E. Concrete Reinforcing

1. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.
 - a. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and method of reinforcement placement and supports, and as herein specified.
 - b. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
 - c. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - d. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement and operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surface.
 - e. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.



F. Concrete Finishes

1. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding ¼" in height rubbed down or chipped off.
2. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with voids, fins or other projections, completely removed and smoothed.
3. Broom Finish: Apply broom finish to sidewalks, curb, and gutters and other areas as directed. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route.

G. Concrete Curing

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 7 days.
 - a. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
 - b. Provide moisture control by one of the following methods:
 - i. Keep concrete surface continuously wet by covering with water.
 - ii. Continuous water-fog spray
 - iii. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges with 4" lap over adjacent absorptive covers.
 - iv. Coat concrete with curing and sealing compound as per manufacturer's recommendations.

H. Walks, Ramps and Pedestrian Traffic Areas

1. Provide all exterior concrete ramps, walks, loading docks, aprons, and other such surfaces subject to weather with a non-slip broom finish.
2. Sidewalks and pedestrian pavements shall include welded wire mesh reinforcement or an approved equal. Fiberglass reinforcement is not an acceptable reinforcement.

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