
PART 1 GENERAL**1.1 SUMMARY**

- A. Section Includes:
1. Concrete Subslabs.
 2. Concrete Footings.
 3. Miscellaneous Concrete Work.

1.2 REFERENCES

1. ASTM — American Society for Testing and Materials:
 2. A 185 — Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
 3. A 497 — Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
 4. A 615 — Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 5. C 33 — Specification for Concrete Aggregates.
 6. C 39 — Test Method of Compressive Strength of Cylindrical Concrete Specimens.
 7. C-94 — Specification for Ready-Mixed Concrete.
 8. C 143 — Test Method for Slump of Hydraulic Cement Concrete.
 9. C 150 — Specification for Portland Cement.
 10. C 171 — Specification for Sheet Materials for Curing Concrete.
 11. C 172 — Practice of Sampling Freshly Mixed Concrete.
 12. C 260 — Specification for Air-Entraining Admixtures for Concrete.
 13. C 309 — Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 14. C 494 — Specification for Chemical Admixtures for Concrete.
 15. C 618 — Specification for Coal Fly Ash and Raw Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 16. C 979 — Specification for Pigments for Integrally Colored Concrete.
 17. C 1107 — Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 18. C 1116 — Specification for Fiber-reinforced Concrete and Shotcrete.
 19. D 1557 — Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 20. D 1751 — Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
 21. D 1752 — Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- B. AWS — American Welding Society:
1. 3.0-41 — Standard Qualification Procedure.
 2. D1.4 — Structural Welding Code — Reinforcement.
 3. D12.1-61 — Reinforced Concrete Construction.
- C. CRSI — Concrete Reinforcing Steel Institute: MSP-1 — Manual of Standard Practice.
- D. ACI — American Concrete Institute:
1. 117 — Specification for Tolerances for Concrete Construction and Materials.
 2. 301 — Specification for Structural Concrete for Buildings, Latest Edition.
 3. 315 — Details and Detailing of Concrete Reinforcing, Latest Edition.
 4. 304R — Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 5. 305R — Hot Weather Concreting.

1.3 DEFINITIONS

- A. Architectural Concrete: Concrete Work with exposed surfaces such as stairs, planter walls, paving, curb ramps, and concrete headers.
- B. Non-Architectural Concrete: Concrete Work without exposed surfaces such as footings and foundations.

- C. Finishing Tolerances:
1. "Class A": True plane within 1/8 inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.
 2. "Class B": True plane within 1/4 inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction.
- D. Acceptance, Acceptable, or Accepted: Acceptance by the Owner's Representative in writing.

1.4 SUBMITTALS

- A. LEED Submittals: Within 30 days of Contract award, assemble and submit all LEED material information on the "LEED Material Tracking Spreadsheets" and forms provided in the Project Manual, together with all supplemental documentation as required by LEED.
- B. Environmental Submittals:
1. Credit MR 4.1 and 4.2: Product data indicating percentage by weight of post-consumer and post-industrial recycled content for products having recycled content. Include a statement indicating projected costs for each product having recycled content.
 2. Credit MR 5.1 and 5.2: Product data indicating location of extraction and processing and location of manufacture. Include a statement indicating projected costs for each product being extracted, processed, and manufactured within 500 air miles of the Project Site.
- C. Product Data:
1. Expansion joint fill material.
- D. Shop Drawings: Fully detailed Shop Drawings clearly showing reinforcement bending diagrams, placing details, size and location of reinforcing steel, overlaps, dowels and any welding to be done; joints, formwork and assemblies.
- E. Samples:
1. Expansion Joint Fill Material — submit three 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Design Data: Conmix design data for each concrete mix.
- B. Test Reports: Compressive strength of concrete test cylinders taken upon delivery of concrete.
- C. Delivery Documentation: Batch tags for each load of concrete.

1.6 QUALITY ASSURANCE

- A. Installer: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. Regulatory Requirements: Meet requirements of applicable laws, codes, and regulations required by authorities having jurisdiction over Work.
- C. Mock-ups:
1. Mock-up location as accepted by Owner's Representative.
 2. Provide one 20 foot by 10 foot mock-up of subslab including one of each type of control joint and edge detail.
 3. Include the specified control joints, expansion joint fill material, expansion joint sealant, edge treatments.
 4. Construct as many mock-ups as necessary to achieve an accepted finish over the entire surface of each mock-up.
 5. Mock-ups which are completely or partially finished incorrectly will be rejected.
 6. Remove rejected mock-ups immediately from the site.
 7. Mock-ups may be installed and remain as part of the permanent installation if acceptable by the Owner's Representative.

8. The mock-ups, when accepted, shall become the Project standard for tolerances and appearance.
- D. ACI Requirements: Meet requirements of ACI 301.
- 1.7 DELIVERY, STORAGE AND HANDLING**
- A. Welded Wire Fabric: Leave tags designating size and spacing on each sheet until installed.
- 1.8 SITE CONDITIONS**
- A. Environmental Requirements for Concrete Placement:
1. Protect concrete against extreme cold and heat, frost, rapid drying, and damage by rain.
 2. In hot dry weather, erect temporary wind breaks to reduce the wind velocity over the concrete surface.
 3. In hot dry weather, erect temporary sun shades to help control concrete surface temperature.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Performance/Design Criteria:
1. Environmental Requirements:
 - a. Credit MR 4.1 and 4.2: Provide mixes with minimum 30% post-industrial recycled content based on total weight of all mix design components.
 - b. Credit MR 5.1 and 5.2: Provide mixes with minimum 50% mix design components being sourced within 500 air miles of the Project Site based on total weight of all mix design components.
- B. Cement for Concrete: ASTM C 150, Type II Portland Cement.
- C. Reinforcing Bars: ASTM A 615, grade 60, deformed billet-steel bars, clean and free from rust, scale, or coating that will reduce bond.
- D. Tie Wire: 16 gauge or heavier, black annealed wire.
- E. Supports for Reinforcement:
1. Meet requirements of CRSI-MSP-1.
 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic, plastic-protected, or stainless steel.
- F. Round Expansion Joint Dowels: ASTM A 615, smooth, billet-steel bars, clean, and free of rust and scale.
- G. Water: Clean, potable, concrete mixing water free from injurious amounts of salts, oils, acids, alkalis, organic materials, iron, rust or other deleterious substances which would cause staining.
- H. Air Entrainment: ASTM C 260, non-staining.
- I. Expansion Joint Fill Material: ASTM D 1752 Type II cork, or ASTM D 1752 Type I, sponge rubber with 30 to 40 pounds per cubic foot density, 95 percent minimum recovery and compatible with joint sealant to be used.
- J. Form Release Agent: Non-staining material.
- K. Chemical Admixtures: ASTM C 494. For colored concrete mixes, consult color admix manufacturer to verify compatibility with color admixture.
- L. Curing Compound: ASTM C 309, Type II non-staining, resin-based, white-pigmented.
- M. High Range Water Reducing Admixture: ASTM 494, Type F or G.
- N. Aligners for Round Expansion Joint Dowel Sleeves: PNA Dowel Aligners; Greenstreak Speed Dowel Bases; or equal.

- O. Caps for Round Expansion Joint Dowels: Plastic, ± 4 inches long, specifically designed and manufactured to fit over expansion joint dowels to allow longitudinal movement of the dowels after the concrete has hardened.
- P. Debonding Compound: Product specifically engineered and commercially manufactured to use on concrete slip-dowels to provide complete bond breakage after the concrete hardens.
- Q. Fly Ash: ASTM C 618, Class F, limited to 25 percent of cementitious material by weight.
- R. Plate Dowels: Greenstreak Speed Plate System, including steel load plates and pocket formers, with plate sizes indicated on the Drawings.
- S. Shrinkage Reducing Admixture: Grace Eclipse 4500.

2.2 MIXES

- A. Architectural Concrete:
 - 1. 4,000-psi minimum strength at 28 days and maximum 4-inch slump maximum 0.45 water- cement ratio.
 - 2. Submit mix design data to the Owner's Representative for review prior to mixing.
- B. Mixing Concrete: Meet requirements of ASTM C 94.
- C. Grout: ASTM 1107, packaged nonshrink, structural cement grout.
- D. Mixing Grout: Mix to a uniform consistency in accordance with the manufacturer's current printed instructions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. General: Examine site and verify that conditions are suitable to receive Work and that no defects
- B. or errors are present which would cause defective installation of products or cause latent defects in workmanship and function.
- C. Substrate Verification: Verify that substrate is at correct elevations.
- D. Notification of Unsuitable Conditions: Before proceeding with Work, notify the Owner's Representative in writing of unsuitable conditions.

3.2 PREPARATION

- A. Protection:
 - 1. Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, plant materials and walks on or adjacent to the site of the Work.
 - 2. Provide barricades, fences or other barriers to protect existing conditions to remain from damage during construction.
 - 3. Use every possible precaution to prevent excessive compaction of planting area soil within or adjacent to the areas of Work.
 - 4. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of plants to remain.
 - 5. Submit written notification of damaged plants and structures to the Owner's Representative in writing.

3.3 FORMWORK

- A. General:
 - 1. Construct forms accurately to dimensions, plumb and true to line and grade.
 - 2. Use forms that are strong, mortar tight, braced and tied so as to maintain position and shape during placing of reinforcing and concrete.
 - 3. The exposed formwork face shall not have any nail heads or screws fixed through the contact face.

4. Avoid direct contact of hammers or metal objects with the exposed formwork face.
 5. Wavy surfaces and bulged walls or slab surfaces resulting from settlement or springing of formwork will be rejected.
 6. Carefully verify and check forms for alignment and level as the Work proceeds.
 7. Make needed adjustments or add additional bracing prior to pouring concrete.
- B. Formwork Material at Exposed Surfaces: Smooth metal, resin-coated plywood, or high-density overlay plywood which will provide an ultra smooth surface.
- C. Tolerances for Exposed Concrete:
1. Top of form units shall not vary more than 1/8-inch from a 10 feet long straight edge.
 2. Vertical faces shall not vary more than 1/8-inch from a 10 feet long straight edge.
- D. Joints:
1. Construct forms and assemble them in such a manner so that joints occur at locations indicated on the Drawings.
 2. Seal joints with silicone sealant to prevent leakage and provide exposed finish surfaces free of joint marks or any indication of where the form joints occurred.
- E. Corners:
1. Form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed to face of concrete.
 2. Form exposed corners to produce square smooth, solid unbroken lines, unless indicated otherwise.
- F. Other Trade Requirements:
1. Construct chases, slots and recesses as required.
 2. Locate inserts, anchor plates and other items to be embedded in concrete where required, properly place and securely anchor.
- G. Recesses and Openings: Provide as shown on the Drawings.
- H. Prior to Pouring Concrete:
1. Thoroughly clean out forms to be used.
 2. Thoroughly wet wood forms where form coatings are not used.
- I. Removal of Forms: Do not remove supporting forms or shoring until concrete has sufficient strength to carry its own weight and other loads upon it.
- J. Remove forms only after concrete has properly set and without damaging concrete.
- K. Re-use of Forms:
1. Do not reuse if there is any evidence of surface wear or tear which would impair quality of exposed finishes.
 2. Store formwork and form materials in such a manner as to prevent damage or distortion.
 3. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage to concrete finish.
- 3.4 REINFORCEMENT**
- A. ACI and AWS Requirements: Meet applicable requirements of ACI 315 and AWS D1.4.
- B. Coordination With Other Trades: Coordinate other trades' schedules to avoid disturbing or moving
- C. Work already installed by one trade to admit the Work of another.
- D. Supports:
1. Accurately and securely fasten or support reinforcements to prevent displacement before or during pouring.

2. Hang footing bars from forms.
 3. Support wire mesh with metal cradles.
- E. Reinforcement Splices:
1. Overlap welded wire fabric one mesh minimum.
 2. Overlap reinforcing bar 24 times the bar diameter minimum, except where indicated.
- F. Round Expansion Joint Dowels:
1. Center vertically in slab unless indicated otherwise.
 2. Center longitudinal position of each dowel horizontally on joint, except where indicated otherwise.
 3. Install at spacing indicated on the Drawings.
 4. Install a sleeve on one end of each square dowel as indicated on the Drawings.
 5. Install a cap on one end of each round dowel as indicated on the Drawings.
 6. Prior to installing the caps on the round dowels, completely coat surfaces of each dowel on the cap-side of the expansion joint with debonding compound.
 7. Cut holes in expansion joint fill material accurately to fit tightly around dowels so that concrete will not leak into gaps between the dowels and the expansion joint material.
 8. Install dowels 90 degrees horizontally and vertically to expansion joint using dowel aligners to help maintain this alignment.
 9. Install the dowel aligners in accordance with the manufacturer's current printed instructions.
- G. Clearances:
1. Provide a minimum 2-inch clearance between bar and concrete top surfaces and side edge surfaces, except where indicated otherwise.
 2. Provide a minimum 3-inch clearance between bar and concrete bottom surfaces, except where indicated otherwise.

3.5 CONCRETE PLACING

- A. Dampening Substrate and Reinforcement: Immediately prior to placing concrete, thoroughly dampen reinforcement and the substrate on which concrete is to be placed.
- B. Placement: Meet applicable requirements of ACI 304R, Chapter 5.
- C. Hot Weather Placement: Meet applicable requirements of ACI 305R.
- D. Cold Weather Placement: Meet applicable requirements of ACI 306R.

3.6 SCORE JOINTS

- A. Location, Width and Radius: As detailed on the Drawings.
- B. Striking: Form in fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained.

3.7 EXPANSION JOINT FILL MATERIAL

- A. Locations and Widths: Provide joint material as shown on the Drawings, and where concrete paving abuts walls, curbs, or other structures.
- B. Installation:
1. Place joint materials with top edge below the paved surface as shown on the Drawings.
 2. Secure in place to prevent movement.
 3. Install a rigid joint cap over the top of the fill material if required to keep top of fill material straight.
 4. Install fill material plumb and down to surface of base material so that no concrete will leak under fill material.
 5. Cut holes in expansion joint fill material accurately to fit tightly around dowels so that concrete will not leak into gaps between the dowels and the expansion joint material.
- C. Forming: Form edges of joints in the fresh concrete using an edging tool to provide a smooth uniform impression.

3.8 FINISHES

- A. Finish Locations: See Article 3.14 below for schedule of finishes.
- B. Floated Finish for Horizontal Surfaces:
 - 1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating.
 - 2. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
 - 3. During or after the first floating, check the planeness of the surface with a ten foot straightedge applied at not less than two different angles.
 - 4. Cut down high spots and fill low spots, and produce a surface with a Class B tolerance throughout.
 - 5. Re-float the slab immediately to a uniform sandy texture.
 - 6. Do not float concrete excessively so that an excessive concentration of cement paste and fines are brought to the surface.
 - 7. Do not use a jitterbug.
- C. Finish for Subslab Surfaces: Medium Broom Finish

3.9 CURING

- A. Curing Compound:
 - 1. Apply to exposed surface of concrete as soon as manufacturer recommends with an airless sprayer.
 - 2. Meet requirements of manufacturer's current printed application instructions.
 - 3. Uniformly apply 2 coats and apply the second coat at right angle to first coat.
 - 4. Apply compound to form a continuous, uniform, coherent film that will not check, crack, or peel.
 - 5. Do not apply to concrete that is still bleeding, or has a visible water sheen on the surface.
 - 6. Protect paving surfaces from foot traffic with scuff-proof paper.
 - 7. Immediately re-coat damaged areas of curing compound.

3.10 PATCHING

- A. Projections: Remove projecting fins, bolts, wire, nails, etc., not necessary for the Work, or cut them back 1 inch from the surface and patch in an inconspicuous manner.
- B. Voids:
 - 1. Fill holes with an accepted patching material the same color and texture as the adjoining concrete.
 - 2. Mix and place patching material and finish flush with the adjacent surface.
- C. Corrective Patching:
 - 1. Correct defects in concrete Work.
 - 2. Chip voids to a depth of at least 1 inch with the edges perpendicular to the surface and parallel to form markings
 - 3. Fill voids, surface irregularities, or honey-combing by patching or rubbing.
 - 4. Insure that concrete surfaces so repaired duplicate the color and texture of the un-patched Work.
- D. Defective Work: Remove in its entirety and replace defective concrete Work which after corrective patching fails to duplicate the appearance of un-patched Work as determined by the Owner's Representative and fails to meet the requirements of these Specifications.

3.11 FIELD QUALITY CONTROL

- A. Testing Concrete upon Delivery:
 - 1. Provide minimum three 6-inch by 12-inch cylinders for each 150 cubic feet or 5,000 square feet of pour for testing of compressive strength.
 - 2. Test 1 cylinder at 7 days, test second cylinder at 28 days, and test third cylinder only if needed for confirmation of compressive strength.
 - 3. Meet requirements of ASTM C 39 and ASTM C 172.

3.12 CLEANING

A. Concrete Work:

1. Prior to final review, remove stains, dirt and other materials using water and mild detergents.
2. Do not use other methods of cleaning unless accepted by the Owner's Representative.

3.13 PROTECTION

- A. Concrete Work: Protect Work against damage and defacement during subsequent construction operations until Final Completion by installing fencing, barriers and protective coverings.

3.14 SCHEDULES

A. Concrete Schedule:

<u>Element</u>	<u>Color</u>	<u>Exposed Surface Finish</u>
Concrete Subslabs	No Color	Medium Broom, Class A
Concrete Footings:	No color	Class B

END OF SECTION