

For more information, contact *Master Builders Solutions*; 23700 Chagrin Blvd., Beachwood, OH 44122; Phone: (800) 628-9990; Website: <https://www.master-builders-solutions.com/en-us/support-for-professionals/technical-service/specifications>

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SECTION 03 33 23

INTEGRALLY COLORED CONCRETE

[SECTION 32 13 16]

[DECORATIVE CONCRETE PAVING]

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for Integrally Colored Cast-in-Place Concrete for [slabs-on-ground,] [sidewalks,] [driveways,] [patios,] [roads,] [parking lots,] [_____,] [and] [other exterior concrete pavements].

1.2 RELATED SECTIONS

- A. Related Sections:
1. Section 01 33 00 Submittal Procedures
 2. Section 01 45 00 Quality Control
 3. Section 03 10 00 Concrete Forming and Accessories
 4. Section 03 20 00 Concrete Reinforcing
 5. Section 03 30 00 Cast-in-Place Concrete
 6. Section 03 35 00 Concrete Finishing
 7. Section 07 92 00 Joint Sealants
 8. Section 32 13 30 Rigid Paving

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI SPEC-301 - Specification for Concrete Construction
 - 2. ACI SPEC-301M - Specification for Concrete Construction (Metric)
 - 3. ACI SPEC-305.1 - Specification for Hot Weather Concreting
 - 4. ACI SPEC-306.1 - Standard Specification for Cold Weather Concreting
 - 5. ACI SPEC-308.1 – Specification for Curing Concrete

- B. ASTM International (ASTM):
 - 1. ASTM C33/C33M - Standard Specification for Concrete Aggregates
 - 2. ASTM C94/ 94M - Standard Specification for Ready-Mixed Concrete
 - 3. ASTM C150/C150M - Standard Specification for Portland Cement
 - 4. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete
 - 5. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete
 - 6. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - 7. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete
 - 8. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars
 - 9. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
 - 10. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

- C. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M 194M/M 194 - Standard Specification for Chemical Admixtures for Concrete

1.4 SUBMITTALS

- A. In accordance with 01 33 00.
 - 1. Product data:
 - a. Fly ash
 - b. Slag cement
 - c. Metakaolin
 - d. Coloring admixture
 - e. Curing compound
 - f. Manufacturer’s color selector chart showing the colors available.
 - 2. Mixture proportions.

3. Certification: Manufacturer's certification stating that the products delivered meet or exceed Project Specifications.
4. Ready-mixed concrete delivery tickets.
5. Qualification Data: For firms indicated in Quality Assurance Article, including list of completed projects.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with 10 years' experience in the production of specified products or specialty construction chemicals.
- B. Installer Qualifications: An installer with [5] [___] years' experience with work of similar scope and quality.
- C. In accordance with ACI SPEC-301 (ACI SPEC-301M) for mixing, transportation, placing and consolidation of concrete.
- D. In accordance with ACI SPEC-305.1 for hot weather concrete placement and protection.
- E. In accordance with ACI SPEC-306.1 for cold weather concrete placement and protection.
- F. In accordance with ACI SPEC-308.1 for curing concrete.
- G. Manufacturer's representative shall be notified at least one week before start of Work.
- H. Field Mockup:
 1. At location on Project selected by Architect/Engineer, construct Field Mockups using procedures, equipment, materials, simulated repairs, curing procedures and quality control plan submitted for production of cast-in-place colored concrete. Include samples of control, construction, and expansion joints in sample panels. Field Mockup shall be produced by the workers who will perform the work for the Project.
 2. The area of the mockup slab shall be 10 ft by 10 ft (3 m by 3 m) [_____].
 3. For accurate color, the quantity of concrete mixed to produce the sample shall not be less than 3 cubic yards (2.5 cubic meters) (or not less than 1/3 the capacity of the mixing drum on the ready-mixed concrete truck).
 4. Accepted Field Mockup provides visual standard for work of this Section.
 5. Field Mockup shall remain through completion of work for use as a quality standard for finished work.
 6. Retain samples of cement, supplementary cementitious materials, aggregates and admixtures used in Field Mockup for comparison with materials used in the Work.
 7. Remove Field Mockup when directed. [Retain Field Mockup as part of Work].

1.6 DELIVERY, STORAGE AND HANDLING

- A. Coloring Admixture: Comply with manufacturer's instructions. Deliver coloring admixtures into manufacturer's temperature-controlled container and store in clean, dry conditions. Maintain method of storage and temperature of materials as recommended by the manufacturer.
- B. Ready-Mixed Concrete: Ready-mixed concrete truck driver shall provide batch ticket to the Architect/Engineer at the time of concrete delivery. Contents of the batch ticket shall be as specified in ASTM C94/C94M.

1.7 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.
 - 2. Avoid placing concrete if rain, snow, or frost is forecast within 24 hours. Protect fresh concrete from moisture and freezing.
- B. Schedule delivery of concrete to provide consistent mixing times from batching until discharge. Mixing times shall meet manufacturer's written recommendations.

1.8 PRECONSTRUCTION MEETING

- A. A meeting shall be held one week prior to placement of integrally colored concrete to discuss the Project and application materials.
- B. Contractor, Subcontractor, Ready-Mixed Concrete Producer's Representative, and Admixtures Manufacturer's Representative shall be present at the meeting. Architect/Engineer will be present at the meeting.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: Shall conform to ASTM C150/C150M, Type [I] [II] [I/II] [III] [V].
- B. Supplementary Cementitious Materials:
 - 1. Use of supplementary cementitious materials shall be approved by the Architect/Engineer.
 - 2. Fly Ash: Shall conform to ASTM C618.
 - 3. Slag Cement: Shall conform to ASTM C989/C989M.

4. Metakaolin: Shall conform to ASTM C618, Class N.
 - a. Products and Manufacturers:
MasterLife MK 828 by Master builders Solutions.
- C. Aggregates: Fine and coarse aggregates shall conform to ASTM C33/C33M.
- D. Water: Potable. Non-potable water shall conform to ASTM C1602/C1602M.
- E. Air-entraining admixtures shall conform to ASTM C260/C260M and shall be from the same manufacturer as the one that supplies coloring admixture. Use of air-entraining admixtures shall be approved by the Architect/Engineer.
 1. MasterAir Series by Master Builders Solutions.
- F. Chemical admixtures shall conform to ASTM C494/C494M [AASHTO M194M/M 194] and shall be from the same manufacturer as the one that supplies coloring admixture. Admixtures shall not contain intentionally-added chlorides.
 1. Approved Manufacturer: Master Builders Solutions.
- G. Coloring Admixture:
 1. Coloring admixture shall contain pigments conforming to the requirements of ASTM C979/C979M.
 2. Coloring Admixture: MasterColor by Master Builders Solutions.
- H. Curing Compound:
 1. Curing compound shall comply with ASTM C1315.
 2. Product shall be MasterKure CC 1315WB by Master Builders Solutions.
- I. Joint Sealant:
 1. Joint sealants shall be as specified in Section 07 92 00.

2.2 COLORS

- A. Colors of Concreting Materials:
 1. Cement: Color shall be [gray] [white]. Use the same source, type, color and brand throughout the Project.
 2. Supplementary Cementitious Materials: Supplementary cementitious materials may darken or lighten the color of concrete or produce erratic color variation. They also can extend the time of set of the concrete and finishing operations. Before their use, trial batches shall be prepared to determine their impact on time of set, finishing operations and concrete color.
 3. Fine Aggregate: Color shall [be locally available natural sand.] [be manufactured white sand.] [match Architect/Engineer's sample.] Use same source and color throughout the Project.
 4. Coarse Aggregate: [Concrete Producer's standard aggregate complying with specifications.] [_____.] Use same source and color throughout the Project.
 5. Coloring Admixture: As selected by Architect/Engineer from Master Builders Solutions Color Selector Chart.
 6. Chemical admixtures: Use same admixtures throughout the Project.

2.3 CONCRETE MIXTURE PROPORTIONS

- A. Compressive strength of concrete at 28 [___] days shall not be less than [3000 psi (20 MPa)] [4000 psi (27.5 MPa)] [_____].
- B. Slump of concrete shall be consistent throughout the Project at 4 inches plus or minus 1 inch (100 mm plus or minus 25 mm) or less. If high-range water-reducing admixtures are used, slump shall be 9 inches plus or minus 1 inch (225 mm plus or minus 25 mm). Slump flow for self-consolidating concrete (SCC) shall be [_____].
- C. Air content shall be [less than 3 percent] [5 to 7 percent] [_____].
- D. Add coloring admixture to concrete mixture according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PLACEMENT AND CONSOLIDATION

- A. Do not add water to concrete mixture in the field.
 - 1. Place and consolidate concrete as specified in ACI SPEC-301 (ACI SPEC-301M).

3.2 FINISHING

- A. Finishing shall be as specified in Section 03 35 00 - Concrete Finishing.
- B. Troweling or broom-finishing colored concrete shall be performed in the same direction to maintain uniform appearance. Do not add additional water to the surface during the finishing process.

3.3 CURING

- A. Do not use water, plastic film, wet burlap or burlap-backed plastic film for curing integrally colored concrete.
- B. Apply [curing] [curing and sealing] compound according to manufacturer's instructions using manufacturer's recommended application techniques. Apply [curing] [curing and sealing] compound at consistent time for each placement to maintain close color consistency.
- C. Take precautions in hot weather to prevent plastic cracking resulting from excessively rapid drying of the surface, as specified in ACI SPEC-305.1.

3.4 TOLERANCES

- A. Minor variations in appearance of integrally colored concrete, which are similar to natural variations in color and appearance of uncolored concrete, are acceptable.

END OF SECTION