

SECTION 03520**LIGHTWEIGHT CONCRETE****PART 1 GENERAL**

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes cast-in-place lightweight insulating concrete for roof decks.
- B. Related Section: Division 5 Section "Steel Deck" contains requirements that relate to this Section.

1.03 DEFINITIONS

- A. Lightweight Insulating Concrete: Low-density concrete, with an oven-dry unit weight not exceeding 50 lb/cu. ft. (800 kg/cu. m) placed with or without embedded rigid insulation, and classified as follows:
 - 1. Cellular-Type Lightweight Concrete: Low-density concrete made with portland cement, water, and air-producing foaming agents.

1.04 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified. Include mixing and application instructions for each type of lightweight insulating concrete.
 - 1. Include lightweight insulating concrete design designations of a qualified testing and inspecting agency evidencing compliance with requirements.
- C. Shop Drawings including plans, sections, and details showing roof slopes, insulation thicknesses, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.
- D. Design mixes for each lightweight insulating concrete mix, including as-cast unit weight, oven-dry unit weight, and compressive strength.
- E. Material test reports from a qualified independent testing agency evidencing compliance with requirements of the following based on comprehensive testing of current materials:

1. Cement.
 2. Aggregates.
 3. Foaming agents.
 4. Admixtures.
 5. Molded insulation.
- F. Material certificates in lieu of agency test reports, when permitted by Architect, signed by lightweight insulating concrete manufacturer certifying that each material item complies with requirements.
- G. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence lightweight insulating concrete's compliance with building code in effect for Project.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed lightweight insulating concrete work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer of primary materials.
- B. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1077 and ASTM E 329, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Fire-Test-Response Characteristics: Where indicated, provide lightweight insulating concrete identical to that tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: As indicated by design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. FM Listing: Provide lightweight insulating concrete evaluated by Factory Mutual as part of a roof assembly and listed in FM Research Corp.'s "Approval Guide" for Class 1 fire rating and Class 1-60 windstorm ratings.
- E. Provide lightweight aggregates containing no detectable asbestos as determined by the method specified in EPA's 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
- B. Store packaged materials to protect them from elements or physical damage.
- C. Do not use cement that shows indications of moisture damage, caking, or other

deterioration.

1.07 PROJECT CONDITIONS

- A. Do not place lightweight insulating concrete when ambient temperature is at or below 32 deg F (0 deg C).
 - 1. When air temperature has fallen or is expected to fall below 40 deg F (4 deg C), heat water to a maximum 120 deg F (49 deg C) before mixing to attain lightweight concrete at point of placement with temperature of 50 deg F (10 deg C) minimum and 80 deg F (27 deg C) maximum.
- B. Do not place lightweight insulating concrete unless ambient temperature is 40 deg F (4 deg C) and rising.
- C. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cellular Lightweight Concrete:
 - a. Celcore Inc.
 - b. Elastizell Corporation of America.

2.02 MATERIALS

- A. Portland Cement: ASTM C 150, Type I, Type II, or Type III.
- B. Fly Ash: ASTM C 618, Class C or F.
- C. Mineral Aggregate: ASTM C 332, Group I, vermiculite.
- D. Mineral Aggregate: ASTM C 332, Group I, perlite.
- E. Mineral Aggregate: ASTM C 332, Group I, vermiculite or perlite.
- F. Foaming Agent: ASTM C 869.
- G. Water: Clean, potable.

- H. Air-Entraining Admixture: ASTM C 260.
- I. Control Joint Filler: ASTM C 612, Class 2, glass-fiber type; compressing to one-half thickness under a load of 25 psi (172 kPa).
- J. Steel Wire Mesh: Cold-drawn steel wire, galvanized, 0.041-inch (1.04-mm) diameter, woven into 2-inch (50-mm) hexagonal mesh, reinforced with a longitudinal 0.062-inch- (1.57-mm-) diameter wire spaced 3 inches (75 mm) apart.
- K. Steel-Welded Wire Fabric: ASTM A 185, 2-by-2-inch (50-by-50-mm), W0.5 by W0.5, flat sheet, galvanized.
- L. Molded Polystyrene Insulation Board: ASTM C 578, Type 1, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density.
 - 1. Provide units with keying slots of approximately 3 percent of board gross surface area.

2.03 DESIGN MIXES

- A. Prepare design mixes for each type and strength of lightweight insulating concrete by either laboratory trial batch or field test data methods. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
 - 1. Do not use the same testing agency for field quality-control testing.
 - 2. Limit use of fly ash to not exceed 25 percent of Portland cement by weight.
- B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

2.04 CELLULAR LIGHTWEIGHT CONCRETE

- A. Design mix to produce lightweight insulating concrete with the following minimum physical properties using the minimum amount of water necessary to produce a workable mix.
 - 1. As-Cast Unit Weight: 34 to 42 lb/cu. ft. (545 to 675 kg/cu. m) at point of placement, when tested according to ASTM C 138.
 - 2. Oven-Dry Unit Weight: 28 to 32 lb/cu. ft. (450 to 515 kg/cu. m), when tested according to ASTM C 495.
 - 3. Compressive Strength: Minimum 200 psi (1380 kPa), when tested according to ASTM C 495.
 - 4. As-Cast Unit Weight: 38 to 48 lb/cu. ft. (610 to 770 kg/cu. m) at point of placement, when tested according to ASTM C 138.
 - 5. Oven-Dry Unit Weight: 30 to 36 lb/cu. ft. (480 to 580 kg/cu. m), when tested according to ASTM C 495.
 - 6. Compressive Strength: Minimum 200 psi (1380 kPa), when tested according to ASTM C 495.

PART 3 EXECUTION

3.01 PREPARATION

- A. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of insulating lightweight concrete. Fill joints with glass-fiber control joint filler.
 - 1. Provide 1-inch - (25-mm-) wide joints for roof areas with dimensions up to 100 feet (30 m) in length; 1.5-inch - (38-mm-) wide joints for roof area dimensions exceeding 100 feet (30 m).
- B. Reinforcing Mesh: Place steel wire mesh with longest dimension perpendicular to steel deck ribs. Cut to fit around roof openings and projections. Terminate mesh at control joints. Lap sides and ends of mesh at least 6 inches (150 mm).
- C. Reinforcing Fabric: Place steel-welded wire fabric with longest dimension perpendicular to steel deck ribs. Cut to fit around roof openings and projections. Terminate fabric at control joints. Lap sides and ends of fabric at least 6 inches (150 mm).

3.02 MIXING AND PLACING

- A. Mix and place lightweight insulating concrete according to manufacturer's instructions, using equipment and procedures to avoid segregation of mix and loss of air content.
- B. Install insulation according to lightweight insulating concrete manufacturer's recommendations. Place insulation in wet slurry poured a minimum of 1/8 inch (3 mm) above the structural substrate. Ensure full contact of insulation with slurry, stagger joints, and tightly butt insulation boards.
 - 1. Install insulation in a stair-step configuration.
- C. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.
- D. Finish top surface smooth, free of ridges and depressions, and maintain surface in acceptable condition to receive subsequent roofing application.
- E. Begin curing operations immediately after placement and air cure for not less than 3 days according to manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency, acceptable to

Architect, to take samples and conduct tests to evaluate lightweight insulating concrete. Do not use same testing service that provided initial mix designs.

- B. Testing Agency: Owner will engage a qualified independent testing agency to take samples and conduct tests to evaluate lightweight insulating concrete.
 - 1. Take samples according to ASTM C 172, except as modified by ASTM C 495.
 - 2. Determine as-cast unit weight during each hour of placement, according to ASTM C 138.
 - 3. Determine compressive strength and oven-dry unit weight according to ASTM C 495. Make a set of at least 6 molds for each day's placement, but not less than 1 set of molds for each 5000 sq. ft. (465 sq. m) of roof area.
- C. Report test results to Architect and lightweight insulating concrete producer within 24 hours of completion of each test.
- D. Additional Tests: Make additional tests when test results indicate as-cast unit weight, compressive strength, oven-dry unit weight, or other requirements have not been met.
- E. Retest in-place lightweight insulating concrete according to ASTM C 513 for compressive strength and oven-dry unit weight.

3.04 DEFECTIVE WORK

- A. Refinish, or remove and replace, lightweight insulating concrete surfaces that are excessively scaled or too rough to receive roofing, according to current published requirements of roofing manufacturer.
- B. Remove and replace lightweight insulating concrete that fails to meet compressive strength and oven-dry unit weight requirements.

3.05 EXISTING LIGHTWEIGHT CONCRETE

- A. Provide a roofing system that does not require the removal and replacement of existing lightweight insulating concrete where possible. Roofing systems that provide specialty fasteners or structural foams are valid alternatives. Coordinate work for reroof projects.
- B. It shall be the Contractors responsibility to perform testing on the existing lightweight to determine the compatibility of the roofing system. All roofing systems shall be subject to approval of the Engineer.

END OF SECTION