

# EF Technology® Sample Concrete Specification

## GENERAL CONCRETE, SECTION 03300 PART 2 - PRODUCTS

### 2.1. CONCRETE MATERIALS

- A. Water: Shall conform to ASTM 1602/C 1602M.
- B. Aggregates: Fine and coarse aggregate shall conform to ASTM C 33.
- C. Lightweight Aggregate: Shall conform to ASTM C 330.
- D. Cementitious Materials:
  - a. It is the owner's intent to utilize cementitious materials that will contribute toward LEED qualification and lessen the CO<sup>2</sup> / Climate Impact on our environment and maximize the use of processed and recycled “green” building materials such as Fly Ash and/or Ground Granulated Blast Furnace Slag at a MINIMUM of 40% by weight of cementitious materials in normal weight and lightweight cast concrete and at a MINIMUM of 30% by weight of cementitious material in post tension concrete shall be used. Use **EF Technology® as supplied by Central Concrete or equal** with materials meeting the requirements below in Sections 2.1 and performance meeting section 2.2 and 2.3 below.
  - b. Proven history of a minimum of 5 projects equivalent in scope or evidence satisfactory to the Structural Engineer of experience working with high volume Supplementary Cementitious Materials (SCM's).
- E. Portland Cement:
  - a. Shall conform to the requirements of Type II, or Type V Portland cement in ASTM Designation: C 150.
  - b. Shall be a maximum content per Table 2.3.1 below and conforming to section 2.1.C.a. above.
- F. Fly Ash:
  - a. Conforming to ASTM C 618, Class C or F, the maximum Loss on Ignition (LOI) shall be less than 3%.
  - b. Substitution of fly ash and / or GGBFS in Normal and Lightweight Concrete:
    - i. A minimum rate of 40% by weight of cementitious material, resulting in a minimum reduction of 40% of CO<sup>2</sup> emissions released into the atmosphere measured in accordance with the *World Resource Institute* (WRI).
- G. Ground Granulated Blast Furnace Slag Cement (GGBFS):
  - a. Shall conform to ASTM C 989 or AASHTO M 302 Grade 100 or 120.
  - b. Substitution of GGBFS and / or Fly Ash in Normal and Lightweight Concrete:
    - i. A minimum rate of 40% by weight of cementitious material, resulting in a minimum reduction of 40% of CO<sup>2</sup> emissions released into the atmosphere measured in accordance with WRI.
  - c. Substitution of GGBFS in Post Tension Concrete:

- i. In post tension concrete a minimum rate of 30% of GGBFS by weight of cementitious material, resulting in a minimum reduction of 30% of CO<sup>2</sup> emissions released in the atmosphere measured in accordance with WRI.
- H. Chemical Admixtures: shall conform to ASTM C 494, ASTM C 260, and AASHTO M194. Admixtures shall not contain intentionally added chlorides
- a. Air Entraining Admixtures: Shall conform to ASTM C 260. Use of air entraining admixtures shall be approved by the owners representative.
  - b. Water-Reducing Admixture : ASTM C 494, Type A.
  - c. Mid-range water-reducing admixture: ASTM C 494, Type A/F. Where specified, provide in manufacturer's recommended (mid-range) dosage.
  - d. High Range, Water Reducing Admixture. ASTM C 494, Type F, polycarboxylate formulation designed to minimize segregation and shrinkage.
  - e. Water Reducing and Accelerating Admixture, ASTM C 494, Type D.
  - f. Set-accelerating admixture: ASTM C 494, Type C, non-chloride. Provide in necessary dosage to achieve desired set time.
  - g. Set-retarding admixture: ASTM C 494, Type B. Provide in necessary dosage to achieve desired set time.
  - h. Viscosity-modifying admixture (VMA): ASTM C494, Type S.
- I. Synthetic Fibers: Shall conform to ASTM C 1116/C 1116M.
- J. Waterproofing admixture: Water-Based Hydrophobic Concrete Admixture for Waterproof Construction such as, Hycrete 1000 or 501 as manufactured by Hycrete, Inc.

## 2.2 CONCRETE MIXTURE GOALS

- A. Mixes: Concrete mixes are specified with limits on maximum cement content, minimum SCM content and minimum performance requirements. The ultimate goal of the mixes with respect to concrete materials is to:
- a. Achieve the specified concrete quality (strength and appearance) in the hardened state.
  - b. Meet the design criteria as specified in conjunction with contractor's constructability requirements of workability, set time, strength gain and temperature gradient.
  - c. Maximum contribution to LEED in terms of materials, recycled materials, light reflectivity and thermal considerations.
  - d. Produce a concrete with an embodied energy cost less than the regional average.
  - e. Produce a concrete with carbon dioxide demand with respect to the use of cement significantly less the regional average.

### Note to Engineer:

- 1. Insert appropriate regional averages or a specific numbers of embodied energy costs and CO<sup>2</sup> in 2.2, d. and e.

## 2.3 CONCRETE MIXTURE

- A. Concrete will be delivered from a plant that is NRMCA certified.

- B. Proportion design mixes to produce concrete of the required strength. The contractor shall provide test data of concrete determined by either laboratory trial mix or field test data basis in accordance with or ACI 318.
- C. Design of all concrete mixes shall be supplied by the contractor. All mix designs shall be stamped and signed by a Civil Engineer licensed in the state of CA.
- D. All concrete mixes in the project will be reviewed by the Owner's Testing Agency. The Owner's Testing Agency will review the proposed mixes for each class of concrete, for proportions of aggregate, cementitious material, admixtures and water.
- E. The proportions of the mixes shall be such as to produce concrete of the required slumps, aggregate sizes, shrinkage, and of a consistency that will allow thorough compaction of the concrete into corners and around reinforcing without excessive puddling, spading or vibration, and without permitting the materials to segregate or free water to collect on the surface.
- F. Concrete shall be delivered in accordance with ASTM C 94.
- G. At the Contractor's option the concrete design mixes shall be designed for either pump or for conventional placement procedures. The Owner's Testing Agency will review one mix design form each class of concrete. Additional mixes will be reviewed by the Owner's Testing Agency at the contractor's expense.
- H. The Contractor shall review and approve the proposed concrete mix designs for compatibility with his placing requirements to insure that the concrete as designed can be placed in accordance with the Drawings and Specifications.
- I. Adjustment to concrete mixes: Mix design adjustments may be requested by Contractor when job conditions or test results warrant. Revised mix design must be submitted to and accepted by Owner's Representative before using in work.
- J. Concrete Classes:

35	Compressive Strength (28 days)	Compressive Strength (56 days)	Maximum Cement Content	SCM Minimum Content	28 Day Shrinkage SEAONC Method
Normal Aggregate Concrete					
Mat Foundation	f'c	f'c28 + 1000psi	250	70	
Footings, grade beams, and underpinning	f'c	f'c28 + 1000psi	250	50	
Slad-on -grade, curbs and pads	f'c	f'c28 + 1000psi	300	50	
Aridus Rapid Drying Concrete	<8000 psi	N/A	500	40	
Walls, Slabs, beams and columns	f'c	f'c28 + 1000psi	300	50	
Lightweight Aggregate Concrete					
Fill on Metal Deck	f'c	f'c28 + 1000psi	350	50	

Notes to Engineer:

1. Select 28 or 56 day strengths to meet design and construction requirements
2. Rapid Drying Concrete, as Aridus by Central Concrete or equal, be designed to meet moisture requirements of ASTM F 710 and be tested to meet ASTM F 1869 (3 lb / 1000 sf / 24 hrs) AND ASTM F 2170 (75% Internal Relative Humidity) in 45 days or less.
3. Shrinkage will vary depending on availability of local material. Strongly consider the aggregate available in the geographic area if specifying shrinkage values.

### 3.0 CURING AND PROTECTION

General: Curing shall be in accordance with ACI 308

A. Curing methods:

- a. Moist curing: Continuous misting, sprinkling or ponding.
- b. Moisture-retaining cover curing: After wetting the concrete surface, cover with wet-curing blanket. Lay blanket in accordance with manufacturer's instructions, overlapping edges and extending ends 12 inches beyond area of concrete to be cured. Remove air pockets. Repair any holes or tears that occur using sheeting material and waterproof tape.
- c. Compound curing: Apply specified curing compound as soon as final finishing operations are complete. Use as recommended by the manufacturer's written instructions.

B. Limitations: Accomplish curing by moist curing, moisture-retaining cover curing, or compound curing, subject to the following limitations.

- a. Compound curing will not be permitted for surfaces to which other concrete, mortar or plaster is bonded.
- b. Compound curing will not be permitted for surfaces to receive subsequent application of penetrants.
- c. Compound curing will not be permitted for Aridus, Rapid Drying Concrete substrates to receive flooring.

C. Cold weather requirements: Protect concrete from freezing during the first 7 days after placement.

D. Hot weather requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods.

END OF SECTION