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Guide Specifications

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Notice: This Guide Specification must be carefully reviewed and edited by the Architect or Engineer or other appropriate Professional to meet the requirements of the project and all applicable and local codes. Coordinate this guide with other specification sections as appropriate.

1.0 Reference Standards

- 1.1 ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars
- 1.2 ASTM C157 - Length Change of Hardened Hydraulic-Cement Mortar and Concrete
- 1.3 ASTM C260 - Air-Entraining Admixtures for Concrete
- 1.4 ASTM C494 - Chemical Admixtures for Concrete
- 1.5 ASTM C1581 - Determining Age at Cracking and Induced Tensile Stress Characteristics of Mortar and Concrete under Restrained Shrinkage
- 1.6 ASTM C94 - Ready-Mixed Concrete
- 1.7 ASTM C173 - Standard Test Method for Air Content for Freshly Mixed Concrete - Volumetric Method (typically for Lightweight Concrete)
- 1.8 ASTM C143 - Standard Test Method for Slump of Concrete
- 1.9 ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete
- 1.10 ACI 212 - Chemical Admixtures for Concrete
- 1.11 NSF/ANSI Standard 61: Drinking Water System Components – Health Effects



2.0 Admixtures

- 2.1 Air-Entraining Admixture:
 - 2.1.1 Conform to ASTM C260.
 - 2.1.2 Use in concrete mixes exposed to freeze-thaw environment.
- 2.2 Chemical Admixtures:
 - 2.2.1 Use only specified admixtures unless prior written authorization is obtained from the Engineer.
 - 2.2.2 Each admixture should be added separately to the concrete mix.
 - 2.2.3 Admixtures usage should always conform to the manufacturers' recommendations including dosage rates.
 - 2.2.4 All admixtures must be compatible with all other concrete-mix design constituents.
 - 2.2.5 Calcium chloride is NOT permitted; no chemical admixtures which contain more than 0.1% chloride by weight, will be permitted for us.
 - 2.2.6 Shrinkage-reducing/compensating admixture having the following characteristics:
 - a. Designed to provide BOTH of the following characteristics:
 - i. Expands at a rate that closely compensates for the shrinkage of the concrete mix.
 - ii. Reduces the capillary surface tension of the concrete pore water.
 - b. Provides at least 80% shrinkage reduction as measured and documented by field performance.
 - c. Formulated for use in freezing and thawing weather.
 - d. Dosage rate and mixing sequence shall be per manufacturer's recommendations.
 - e. Shall have documented performance of ASTM C1581, Ring Test, run with concrete (maximum aggregate size not to exceed 0.5 inches): No cracking for minimum 120 days.
 - f. Shall be certified by NSF/ANSI Standard 61: Drinking Water System Components – Health Effects.

- g. Approved Products:
 - i. PREVent-C®* manufactured by Premier CPG (www.premiercpg.com).
 - ii. Or equal (may be supplied by one product that provides both expansion and pore water surface tension or two separate products each added at dosage recommended by manufacturer's technical data sheets).

3.0 Design Mix

- 3.1 Prepare design mixes for each type and strength of concrete in specifications by either laboratory trial batch or field performance methods as specified in ACI 301. For the trial batch method, mix shall be proportioned and stamped by a professional engineer.
- 3.2 Concrete Trial Mixes:
 - 3.2.1 Compressive Strength: Design compressive strength or greater at 28 days according to ASTM C109.
 - 3.2.2 Admixtures to be used in the mix shall be incorporated into the mix design submitted for approval. Shrinkage reducing admixture shall be added after all other admixtures in powder form (do not pre-mix with water).
 - 3.2.3 Trial batch air content shall be within tolerances of the project specifications.
 - 3.2.4 Trial batch slump shall be within tolerances of the project specifications.
 - 3.2.5 Maximum shrinkage 0.035% at 28 days dry-age when tested per ASTM C157 as modified in the Shrinkage Testing Procedure below.

4.0 Shrinkage Testing Procedure

- 4.1 Testing and reporting shall conform to ASTM C157 with the following modifications:
 - 4.1.1 Mold specimens per ASTM C157.
 - 4.1.2 After initial set, loosen the tension screw of the mold to allow the concrete to expand during the first 24 hours.
 - 4.1.3 Remove from molds at 23 +/- 1 hour after batching. Take initial reading immediately after de-molding. This reading is the initial comparator reading (initial CRD) used in calculating the length change at each age.
 - 4.1.4 Wet cure specimens for a period of 7 days, including the period of time the specimens are in the mold. Wet cure may be achieved either through storage in a moist cabinet or room in accordance with ASTM C511, or through storage in lime saturated water. Cure at 73 +/- 3 degrees.

- 4.1.5 Take reading after 7 days of wet curing. This is the first day reading for air drying which is "0" days of drying.
- 4.1.6 Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F +/- 3 degrees and 50 percent +/- 4 percent relative humidity for the remainder of the test.
- 4.1.7 Measurements to determine shrinkage expressed as percentage of base length shall be made a 7, 14, 21, and 28 days after the start of the air drying which is equal to 14, 21, 28, and 35 days after the specimen is cast.
- 4.1.8 Slump of concrete for testing shall match job requirements and need not be limited to restrictions as stated in ASTM C157 section 8.4.
- 4.1.9 Report results in accordance with ASTM C157 at 0, 7, 14, 21 and 28 days of air drying, including actual measurements of length at each age. Calculate length change of specimen at each age as follows:

Length Change - Calculate the length change of any specimen at any age after the initial comparator reading as follows:

$$\Delta L_x = \frac{\text{CRD} - \text{initial CRD}}{G} \times 100$$

ΔL_x = length change of specimen at any age, %.
CRD = difference between the comparator reading of the specimen and the reference bar at any age, and
G = the gauge length (10 in [250mm]) (see note).

Note - In Practice, C490, the comparator dial gage specified for use with 10-in. gauge length specimens shall be graduated in fractions of an inch; the comparator dial gage specified for use with 250-mm gauge length specimens shall be graduated in fractions of a millimeter.

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