

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete materials and mixes for the following:
 - 1. Concrete Cradle and/or Encasement.
 - 2. Reaction Backing (Thrust Blocks).
 - 3. Manhole Base Channel Fill.
 - 4. Manhole Bases.

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
 - 1. ACI 350; Concrete Sanitary Engineering Structures.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials, AASHTO M182 Burlap cloth made from Jute or Kenaf.
- B. American Concrete Institute (ACI):
 - 1. ACI 301; Specifications for Structural Concrete for Buildings.
 - 2. ACI 304; Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
 - 3. ACI 305R; Hot Weather Concreting.
 - 4. ACI 306R; Cold Weather Concreting.
 - 5. ACI 308; Standard Practice for Curing Concrete.
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM C33; Concrete Aggregates, Spec. for.
 - 2. ASTM C39; Compressive Strength of Cylindrical Concrete Specimens, Test Method for.
 - 3. ASTM C94; Ready-Mixed Concrete, Spec. for.
 - 4. ASTM C143; Slump of Portland Cement Concrete, Test Method for.
 - 5. ASTM C150; Portland Cement, Spec. for.
 - 6. ASTM C171; Sheet Materials for Curing Concrete, Spec. for.
 - 7. ASTM C172; Sampling Freshly Mixed Concrete, Method of.

8. ASTM C173; Air Content of Freshly Mixed Concrete by the Volumetric Method, Test Method of.
9. ASTM C231; Air Content of Freshly Mixed Concrete by the Pressure Method, Test Method of.
10. ASTM C260; Air Entraining Admixtures for Concrete, Spec. for.
11. ASTM C309; Liquid Membrane - Forming Compounds for Curing Concrete, Spec. for.
12. ASTM C494; Chemical Admixtures for Concrete, Spec. for.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150 of the following Type:
 1. Type II, Moderate Sulfate Resistance for manhole bases or channel fill.
 2. Type I, Normal.
- B. Normal Weight Aggregates: Meeting requirements of ASTM C33.
- C. Water: Potable quality, clean and free of injurious amounts of oil, acid, alkali, organic matter, suspended matter, and other deleterious substances.
- D. Concrete Admixtures:
 1. Air-Entraining Admixture: Use a product conforming to ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 2. Water-Reducing Admixture: ASTM C494, Type A, and containing not more than 0.1 percent chloride ions.
 3. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G and containing not more than 0.1 percent chloride ions.
 4. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C494, Type E, and containing not more than 0.1 percent chloride ions.
 5. Water-Reducing, Retarding Admixture: ASTM C494, Type D, and containing not more than 0.1 percent chloride ions.
 6. Prohibited Admixtures: Calcium chloride thycyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.
- E. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
 1. Waterproof paper.
 2. Polyethylene film.
 3. Polyethylene-coated burlap.

- F. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
1. Acceptable Manufacturers:
 - a. Master Builders; Masterseal.
 - b. L & M Construction Chemicals; L&M Cure.
 - c. Or Equal.

2.02 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301.
- B. Design Mixes: Provide normal weight concrete with the following properties:
1. 2500 psi 28-day compressive strength.
 2. 3000 psi 28-day compressive strength.
 3. 4000 psi 28-day compressive strength.
- C. Admixtures:
1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in concrete as required for placement and workability.
 2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
 3. Use high-range water-reducing admixture in pumped concrete; concrete required to be watertight, and concrete with water/cement ratios below 0.50.
 4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of $\pm 1\frac{1}{2}$ percent within following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or subjected to hydraulic pressure:
 - 1) 4.5 percent (moderate exposure); 5.5 percent (severe exposure) $1\frac{1}{2}$ " max. aggregate. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) 1" max. aggregate.
 - 2) 5.0 percent (moderate exposure); 6.0 percent (severe exposure) $\frac{3}{4}$ " max. aggregate.
 - 3) 5.5 percent (moderate exposure); 7.0 percent (severe exposure) $\frac{1}{2}$ " max. aggregate.
- D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
1. 3000 psi W/C Ratio: 0.58 maximum (non air-entrained), 0.46 maximum (air-entrained).

2. 2500 psi W/C Ratio: 0.67 maximum (non air-entrained), 0.54 maximum (air-entrained).
- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Slump: Not less than 1" nor more than 4".

2.03 CONCRETE MIXES

- A. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1½ minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1½ minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.
- B. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as herein specified.
1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
 2. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1½ hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 CONCRETE PLACEMENT

- A. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
- B. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.
- C. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.

3.02 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seven (7) days.
 - 2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, in accordance with ACI 308.

3.03 QUALITY CONTROL

- A. Sampling and testing for quality control during placement of concrete may include the following, as directed by Engineer.
 - 1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
 - 2. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - 3. Air Content: ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - 4. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 deg C) and above; and each time a set of compression test specimens made.
 - 5. Compressive Strength Tests: ASTM C39; one (1) set for each day's pour exceeding 5 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at seven (7) days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

END OF SECTION