

SECTION 03302**MISCELLANEOUS CAST-IN-PLACE CONCRETE****PART 1 GENERAL****1.01 SUMMARY**

- A. This section covers all cast in place concrete, including reinforcing steel, forms, finishing, curing, and appurtenant work.
- B. Inch-pound (English) units of measurement are specified herein.
- C. Where MDPW or MassDOT requirements are referenced on the Contract Drawings, such requirements shall govern and shall supersede the requirements specified herein.
- D. Refer the Town of Needham Reference Specifications included in Appendix I for work related to the Town of Needham water, sewer or drain utilities.

1.02 RELATED SECTIONS

- A. Section 02612 – Reinforced Concrete Pipe
- B. Section 03450 – Precast Structures

1.03 CODES AND STANDARDS

- A. American Society for Testing and Materials International (ASTM)
 - 1. ASTM C33 Standard Specification for Concrete Aggregates
 - 2. ASTM C1778 Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
 - 3. ASTM C150 Standard Specification for Portland Cement
 - 4. ASTM C595 Standard Specification for Blended Hydraulic Cements
 - 5. ASTM C1157 Standard Performance Specification for Hydraulic Cement
 - 6. ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - 7. ASTM C989 Standard Specification for Slag Cement for Use in Concrete and Mortars
 - 8. ASTM C494 Standard Specification for Chemical Admixtures for Concrete

9. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
10. ASTM C615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
11. ASTM C1064 Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
12. ACI 318 Building Code Requirements for Structural Concrete

1.04 SUBMITTALS

- A. All submittals shall be made in accordance with the Section 01300 – Submittals.
- B. The following items shall be submitted, as a minimum.
 1. Manufacturer's information for all products and concrete ingredients supplied under this section, in the form of technical data sheets, certificates of compliance, test data, or reports.
 - a. Items required to verify the concrete mixture:
 - 1) Aggregate reports (ASTM C33 and ASTM C1778)
 - i. Source and type
 - ii. Gradation
 - iii. Deleterious materials
 - iv. Alkali-aggregate reactivity
 - 2) Cement mill report
 - 3) Fly ash or slag cement test report
 - 4) Admixture data sheets
 - 5) Proposed mixture proportions
 - 6) Concrete compressive strength at 28 days
 2. Bar lists and drawings for the fabrication and placing of reinforcement, with sufficient plans, elevations, and sections to adequately detail and label all reinforcement. Bar drawings shall also include a reference to the structure where the reinforcement is to be installed and the relevant contract drawings showing the reinforcement.

1.05 QUALITY ASSURANCE (NOT USED)

1.06 QUALIFICATIONS (NOT USED)

1.07 DELIVERY, STORAGE AND HANDLING (NOT USED)

1.08 PROJECT/SITE CONDITIONS (NOT USED)

1.09 DEFINITIONS (NOT USED)

1.10 TOLERANCE (NOT USED)

PART 2 PRODUCTS

2.01 LIMITING REQUIREMENTS

- A. Unless otherwise specified, concrete shall be controlled within the following limiting requirements:

Cement Content	Suitable for meeting the performance requirements of this specification.
Maximum Water-Cement Ratio	The maximum water-cement ratio shall be 0.45 on a weight basis, or, if fly ash or slag cement are used, the combined mass of cement plus fly ash or slag cement shall be used to determine the water-cementitious materials ratio.
Fly Ash or Slag Cement Content	At the option of Contractor, fly ash or slag cement may be substituted for portland cement, on the basis of 1.0 lb added for each 1.0 lb of cement reduction. Fly ash replacement shall be within a range of 15 to 25 percent. Slag cement replacement shall be within a range of 25 to 50 percent.
Concrete Strength	4,500 psi minimum compressive strength at 28 days.
Air Content	6 percent $\pm$ 1.5 percent.

Coarse Aggregate	Maximum nominal coarse aggregate size, 1 inch. Recycled aggregates, or aggregates created from crushed concrete, will not be acceptable.
Admixtures	A water-reducing admixture and an air-entraining admixture shall be included in all concrete. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable.
Consistency	Workable, without segregation, with slump not more than 5 inches when concrete is placed.

2.02 MATERIALS

Cement	ASTM C150 Type II or I/II, or ASTM C595 Type II(MS). ASTM C595 cements that incorporate C1157 cements will not be acceptable.
Fly Ash	ASTM C618, Class F, except loss on ignition shall not exceed 4 percent.
Slag Cement	ASTM C989, Grade 100 or Grade 120.
Fine Aggregate	Non-reactive, clean, natural sand, ASTM C33.
Coarse Aggregate	Non-reactive crushed rock, washed gravel, or other inert granular material conforming to ASTM C33, class 4S, except that clay and shale particles shall not exceed 1 percent.
Water	Potable Water from concrete mixing operations shall not be used.
Admixtures	
Water-Reducing	ASTM C494, Type A or D.
Air-Entraining	ASTM C260.
High-Range Water Reducing	ASTM C494, Type F or G.

Reinforcing Steel	
Bars	ASTM A615, Grade 60, deformed.
Welded Wire Fabric	ASTM A1064, Grade 70.
Bar Supports	CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
Mechanical Connectors	Splicing system meeting Type 2 tensile requirements of ACI 318. Products shall have a current evaluation report verifying testing per ICC-ES AC 133. Use only where indicated on the drawings.
Form Coating	Nonstaining and nontoxic after 30 days. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.
Evaporation Reducer	Dayton Superior "AquaFilm Concentrate J74", Euclid "Eucobar", L&M Chemical "E-Con", Master Builders Solutions "MasterKure ER50", or Sika "SikaFilm"; or equal.

2.03 MIXTURE DESIGN AND TESTING

- A. All reports and tests required for Authority acceptance of materials and concrete mixtures shall be made at the expense of Contractor. Mixtures shall be adjusted in the field as necessary, within the limits specified, to meet the requirements of these specifications. If the type or source of any concrete ingredient is changed during the contract, including a change from ASTM C150 to ASTM C595 cement, concrete work shall pause until the new materials and the new mixture design are acceptable to the Authority. Testing of the new mixture may be necessary.
- B. Review of Materials
 - 1. The source and quality of concrete materials shall be submitted to Authority for review before concrete is placed.
- C. Proposed Mixture Proportions
 - 1. Proposed proportions of concrete shall meet the limiting requirements indicated herein.

D. Field Test Record Data

1. Concrete mixtures may be qualified based on field test record performance data. Field test data records shall be from the production facility being used on the current Project and shall have been performed in the past 24 months. Field test records shall represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 45 days.

2.04 FORMS

- A. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment.
- B. Forms shall be thoroughly cleaned and coated before concrete is placed.
- C. Form-facing materials shall be selected in accordance with ACI 347.3R, based upon the applicable formed concrete surface category. Formed concrete surface categories vary by structure and application, and shall be as indicated in the Finishing Formed Surfaces Paragraph 3.04.A.

2.05 REINFORCEMENT

- A. Reinforcement shall be accurately formed and positioned, and shall be maintained in proper position while the concrete is being placed and compacted. Reinforcement shall be free from dirt, loose rust, scale, and contaminants. Mechanical connectors shall be used only as indicated on the drawings.

PART 3 EXECUTION**3.01 BATCHING, MIXING, AND DELIVERY**

- A. Concrete shall be furnished by a ready-mixed concrete manufacturer (plant) and trucks which are certified by the National Ready Mixed Concrete Association's (NRMCA) Plant and Truck Certification Program, and shall conform to ASTM C94 except as indicated otherwise in this specification. The time from start of concrete mixing to completion of discharge from the truck shall not exceed 90 minutes.

3.02 PLACEMENT

- A. Concrete shall be conveyed to the point of final deposit and placed by methods which will prevent segregation or loss of the ingredients. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Unless otherwise

authorized, compaction shall be by immersion type vibrators. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

B. Polyethylene Film

1. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film. Joints in the film shall be lapped at least six (6) inches and taped.

C. Cold Weather Concreting

1. Except as modified herein, cold weather concreting shall comply with ACI 306.1.

D. Hot Weather Concreting

1. Except as modified herein, hot weather concreting shall comply with ACI 305.1.

3.03 TOLERANCES

- A. Tolerances for cast-in-place concrete work shall be as indicated in ACI 117, and ACI 347.3R based upon the relevant formed concrete surface category.
- B. Formed concrete surfaces that are to have a face-mounted flat steel or FRP member attached, including but not limited to items such as weir plates or shelf angles, shall have more stringent flatness requirements. The surface profile shall permit the installation of the flat member without grinding the concrete surface (except for removal of fins), deforming the flat member, or requiring usage of backer rods or shims.

3.04 FINISHING

A. Finishing Formed Surfaces

1. Formed concrete surfaces shall meet all criteria of the relevant formed concrete surface category (CSC), as defined in ACI 347.3R, except as indicated otherwise herein. Surfaces shall be assigned to CSC's as indicated.

Formed Concrete Surface Category	Applicable Surfaces	Mock Required
CSC1	Formed concrete surfaces that will be in permanent contact with earth backfill.	No
CSC2	All other formed concrete surfaces not designated otherwise.	No

- B. Fins, form seams, and construction joints shall be ground flush on all surfaces in formed concrete surface category CSC2, and in CSC1 surfaces that are required to be dampproofed.
- C. All tie holes in formed surfaces, regardless of the relevant CSC, shall be cleaned, wetted, and filled with patching mortar. The patches shall be finished flush and cured and shall match the texture and color of the adjacent concrete.
- D. Concrete surfaces to be dampproofed shall have fins removed and tie holes filled, but no additional finishing will be required.
- E. Unless otherwise specified, unformed surfaces shall be given a float finish.
- F. Application of Evaporation Reducer
 - 1. Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with an evaporation reducer. The evaporation reducer shall form a continuous film on the surface of fresh, plastic concrete to reduce evaporation.
 - 2. Immediately following screeding, evaporation reducer shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon 4 m²/L, in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray the product at approximately 40 psi 275 kPa with a suitable nozzle as recommended by the manufacturer.
 - 3. The sprayable solution shall be prepared as recommended by the manufacturer.
 - 4. Under severe drying conditions, additional applications of evaporation reducer may be required following each floating or troweling, except the last finishing operation.

3.05 CURING

- A. Concrete shall be protected from loss of moisture for at least seven (7) days by water curing, except that when concrete is being protected from low temperatures, the duration of water curing may be shortened to one day less than the duration of the cold weather protection. Water curing shall be in accordance with ACI 308.1.

**** END OF SECTION ****