SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Concrete pedestals
B. Concrete curing
C. Concrete slab, curbs, and pads

1.02 RELATED REQUIREMENTS

A. Section 014500 - Quality Control.
B. Section 017450 - Construction and Demolition Debris Recovery Plan.
C. Section 031000 - Concrete Forms and Accessories: Forms and accessories for formwork.
D. Section 032000 - Concrete Reinforcement.
E. Section 024174 – Temporary Shoring & Bracing

1.03 REFERENCE STANDARDS

A. CBC - California Building Code; 2016
B. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; most recent edition.
C. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; most recent edition.
D. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; most recent edition.
E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; most recent edition.
F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; most recent edition.
G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; most recent edition.
H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; most recent edition.
I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; most recent edition.
N. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; most recent edition.
Q. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; most recent edition.

1.04 SUBMITTALS

A. See General Conditions for submittal procedures.
B. Concrete Mix Design: The concrete mix design is to be undertaken by the concrete supplier to meet the requirements of the performance specification contained in this document. Proposed mix designs are to be submitted to the Port for review and approval prior to construction.
C. Manufacturer’s Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.
D. Shoring details and calculations if required shall be submitted to the Port for review prior to construction. Shoring details and calculations shall be wet stamped and signed by a licensed Professional Civil or Structural Engineer in the State of California. Refer to Specification Section 024174 for additional temporary shoring and bracing requirements.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.
B. Follow recommendations of ACI 305R when concreting during hot weather.
C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 - PRODUCTS

2.01 FORMWORK
A. Comply with requirements of Section 031000.

2.02 REINFORCEMENT
A. Comply with requirements of Section 032000.

2.03 CONCRETE MATERIALS
A. Cement: ASTM C 150, Type I - Normal portland type.
C. Fly Ash: ASTM C 618, Class C or F.
D. Silica Fume: ASTM C 1240, proportioned in accordance with ACI 211.1.
E. Water: Clean and not detrimental to concrete.

2.04 CHEMICAL ADMIXTURES
A. Limited admixtures may be included in the proprietary concrete mix design and are subject to the review and approval of the Port.
B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
C. High Range Water Reducing Admixture, Plastol Series: ASTM C 494/C 494M Type F, as required to achieve specified slump.
D. Corrosion-Inhibitor, WR Grace DCI-S, Eucon CIA Sika FerroGard 903 or equal, 3 gallons per cubic yard.
E. The compatibility of all admixtures proposed with the other components of the concrete mix shall be considered in the proprietary design.

2.05 BONDING AND JOINTING PRODUCTS
A. Epoxy Bonding System: Complying with ASTM C 881/C 881M and of Type required for specific application.

2.06 CONCRETE MIX DESIGN
A. Performance Specification:
   1. The concrete mix design for the respective areas of concrete construction shall be in compliance with the following performance specification criteria:
      a. Design Life : 50 years. The design life should allow for a service life of 25 years.
         The service life is the time to initiation of corrosion and propagation time to visible cracks.
b. A maintenance life of 25 years should be allowed to achieve the total design life of 50 years.

2. Submit concrete design for the following exposure condition.
   a. Concrete used in internal enclosed environments.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Port for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Normal Weight Concrete for pedestals, slabs, and curbs:
   1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4000 psi
   2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.
   3. Silica Fume Content: 5 percent of cementitious materials by weight.
   4. Water-Cement Ratio: Maximum 38 percent by weight.
   5. Slump: 4 inches maximum.
   7. Corrosion inhibitor: 3 gallons per cubic yard.

PART 3 - EXECUTION

3.01 PREPARATION
   A. Verify that forms are clean and free of rust before applying release agent.
   B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories. Formwork for cast-in-place concrete may be supported off the existing concrete piers. The contractor shall be responsible for the design of all connections to existing structure and subsequent patching.
   C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
      1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   D. In locations where new concrete is doweled to existing work, drill holes in existing concrete and insert steel dowels with Simpson SET-XP epoxy or equal.

3.02 PLACING CONCRETE
   A. Place concrete in accordance with ACI 304R.
B. Notify the Port not less than 24 hours prior to commencement of placement operations.

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

D. Install joint devices in accordance with manufacturer's instructions.

E. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

F. A significant proportion of new concrete work is above water (San Francisco Bay). A construction methodology for the placing of concrete shall be used to ensure no material falls into the San Francisco Bay during construction. All applicable local ordinances for work over the Bay are to be complied with.

G. Do not interrupt successive placement; do not permit cold joints to occur.

3.03 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork. All repairs to concrete finish shall be subject to the review and approval of the Port. The repair technique shall use the same quality concrete as the substrate mix and shall be bonded in an approved manner and maintain the specified covers to embedded metal items (rebar, ties etc.).

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

3.04 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: As required by proprietary mix designer requirements, but not less than 7 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   2. Final Curing: Begin after initial curing but before surface is dry.

3.05 FIELD QUALITY CONTROL
A. An independent testing agency will perform field quality control tests, as specified in Section 014500.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to Structural Engineer and inspection and testing firm for review prior to commencement of concrete operations.

D. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.

E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.06 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to the Port and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. The contractor shall report any defective concrete to the Port with proposed repair methodology for review and approval. The cost of the repairs for any defective concrete shall be borne by the general contractor.

END OF SECTION