

## SECTION 04 72 00

### CAST STONE MASONRY

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. This Section specifies precast concrete sign posts, watering station pedestals and collars, and concrete bench, with supports, anchors, attachments, and embedded items, manufactured and installed to simulate natural cut stone. Cast Stone is made from fine and coarse aggregates, portland cement, mineral oxide color pigments, chemical admixtures and water to simulate a natural stone.

##### 1.2 RELATED WORK

- A. Section 03 30 00, CAST IN PLACE CONCRETE.
- B. Joint sealing: Section 07 92 00, JOINT SEALANTS.
- C. Site signage sheet aluminum with vinyl letters and numbers for installation on sign pedestals: Section 10 14 00, EXTERIOR SIGNAGE.

##### 1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards Contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for Project local/regional materials, recycled content, and other sustainability requirements.

##### 1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Provide cast stone sample panel, minimum size 4 inch by 12 inch by 12 inch, for each color and each finish.
  - 2. Show finish on two 4 inch edges and 12 inch by 12 inch surface.
- C. Shop drawings:
  - 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
  - 2. Lifting devices: Submit design details for lifting devices (not straps or slings) that will support the pieces at vertical lifting points using protective pads of materials that will not damage the stone.
- D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification. Certification documents must be current within one year of preconstruction meeting.

- E. Submit manufacturers test results of cast stone previously made by manufacturer, indicating compliance with ASTM C1364.
- F. Laboratory Qualifications: Description of testing laboratories facilities and qualifications of its principals and key personnel.
- G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age. Include representative project photographs.
- H. Installer Qualifications: Provide documentation of requirements specified herein.

## 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Store cast stone under waterproof covers on planking clear of ground.
- B. Protect from handling, dirt, stain, and water damage.
- C. Mark production units with the identification marks as shown on the shop drawings.
- D. Package units and protect them from staining or damage during shipping and storage.
- E. Provide packaging and lifting devices from the manufacturer that are designed to permit the installer easy removal for inspection, or to handle the cast stone for installation without causing damage to the units.
- F. Provide an itemized list of product to support the bill of lading.

## 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- B. American Concrete Institute (ACI):  
318/318M ..... Building Code Requirements for Structural Concrete and  
Commentary  
Architectural Precast Association; certification program.
- C. American Society for Testing and Materials (ASTM):  
A185/A185M..... Steel, Welded Wire Reinforcement, Plain, for Concrete  
A240 ..... Standard Specification for Chromium and Chromium-  
Nickel Stainless Steel Plate, Sheet, and Strip  
A276 ..... Stainless Steel Bars and Shapes  
A615/A615M..... Deformed and Plain Carbon-Steel Bars for Concrete  
Reinforcement  
A666 ..... Standard Specification for Annealed or Cold-Worked  
Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar  
C33/C33M ..... Concrete Aggregates

C150.....	Portland Cement
C173.....	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C231.....	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260.....	Air-Entraining Admixtures for Concrete
C426.....	Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units
C494.....	Chemical Admixtures for Concrete
C618.....	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C979.....	Pigments for Integrally Colored Concrete
C989.....	Slag Cement for Use in Concrete and Mortars
C1194.....	Compressive Strength of Architectural Cast Stone
C1195.....	Absorption of Architectural Cast Stone
C1364.....	Architectural Cast Stone
D2244.....	Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

- D. Cast Stone Institute Technical Manual and Cast Stone Institute standard Specifications.

## 1.7 QUALITY ASSURANCE

### A. Manufacturer:

1. Must have five years' minimum continuous operating experience, and have facilities for producing cast stone of the shapes, quantities and size required for this Project.
2. Must be a producer certified by the Cast Stone Institute or the Architectural Precast Association.
3. Producer assumes responsibility for engineering units to comply with performance requirements and use indicated, including a comprehensive engineering analysis by a qualified Professional Engineer who is licensed in their place of practice and who is experienced in providing engineering services of the kind indicated.
4. Shop drawings to bear seal and signature of Professional Engineer responsible for the design and preparation.

### B. Installer:

1. Must provide documentation demonstrating that they have a minimum of five years' experience setting cast or natural building stone.
2. Provide written handling and installation procedures that will be followed for the installation of the Work for cast stones lifted, moved, adjusted in any way, other than by hand. Describe procedure starting at the inspection of the products once delivered to the site and continue through the final setting of the cast stone units with them being secured into place in the Work. Include procedures with description of the equipment that will be used, as well as all protection procedures to be followed, to ensure that no exposed surfaces or edges of the cast stone are damaged during handling or installation.

3. Provide written procedures for removal and replacement of cast stone units that have been damaged on any edges or faces that will be visible in the final installation, including drip slots.
  4. Provide procedures for inspection and identification of any exposed damage, with procedures for immediate marking of the units to be removed and replaced prior to grouting or sealing of joints.
- C. Testing:
1. Follow the procedures in ASTM C1364.
  2. One (1) sample from production units may be selected at random from the field for each 500 cubic feet delivered to the job:
    - a. Three (3) field cut cube specimens from each of these sample to have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as specified.
    - b. Three (3) field cut cube specimens from each of these samples to have an average maximum cold-water absorption of 6 percent.
    - c. Test field specimens in accordance with ASTM C1194 and C1195.
    - d. Manufacturer to submit a written list of projects similar and at least three (3) years of age, along with Owner, Architect and Contractor references.

## 1.8 MANUFACTURING TOLERANCES

- A. Cross section dimensions must not deviate by more than + 1/8 inch from approved dimension.
- B. Length of units must not deviate by more than length/360 or + 1/8 inch, whichever is greater, not to exceed + 1/4 inch. Maximum length of any unit must not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp bow or twist of units must not exceed length/360 or + 1/8 inch, whichever is greater.
- D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features: On formed sides of unit, 1/8 inch, on unformed sides of unit, 3/8 inch maximum deviation.

## 1.9 MOCK-UP

- A. For each precast component listed below, fabricate and erect at site, one full size panel, illustrating shape, lifting device, and attachment points, and finish in accordance with approved sample.
  1. Sign Posts:
    - a. One Sign Type D Section Marker post
  2. Water Station post – 12 inch minimum length
  3. Seating bench
- B. Include mock-up with typical reveals, joints, numbering and lettering and sealants.

- C. Locate mock-ups where directed.
- D. Mock-ups may remain as part of the Work upon written approval to do so from COR.

## PART 2 - PRODUCTS

### 2.1 ARCHITECTURAL CAST STONE

- A. Comply with ASTM C1364.
- B. Physical Properties: Provide the following:
  - 1. Compressive Strength – ASTM C1194: 6,500 psi minimum for products at 28 days.
  - 2. Absorption – ASTM C1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.
  - 3. Air Content for Wet Cast Product – ASTM C173 or C231: 4-8 percent.
  - 4. Freeze Thaw - ASTM C1364: The cumulative percent weight loss (CPWL) less than 5 percent after 300 cycles of freezing and thawing.
  - 5. Linear Shrinkage - ASTM C426: Maximum 0.065 percent.

### 2.2 RAW MATERIALS

- A. Portland Cement: Type I or Type III, white and/or grey to achieve desired finish colors. Use only one brand, type, and color from the same mill. Gray cement may be used for non-exposed backup mixes, ASTM C150.
- B. Coarse Aggregates: Granite, quartz or limestone, ASTM C33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine Aggregates: Manufactured or natural sands, ASTM C33, except for gradation.
- D. Colors: Inorganic iron oxide pigments, ASTM C979 except that carbon black pigments cannot be used.
- E. Admixtures: Comply with the following:
  - 1. ASTM C260 for air-entraining admixtures.
  - 2. ASTM C494/C495M Types A-G for water reducing, retarding, accelerating and high range admixtures.
  - 3. Other Admixtures: Integral water repellents and other chemicals, for which no ASTM Standard exists, must be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
    - a. Produce units with water repellant accepted by fabricator within mix design; product for mix design and setting mortar to be from same source.
  - 4. ASTM C618; do not use mineral admixtures of dark and variable colors in surfaces intended to be exposed to view.

- 5. ASTM C989; granulated blast furnace slag may be used to improve physical properties, as verified by testing documentation.
- F. Water: Potable.
- G. Reinforcing Bars:
  - 1. ASTM A615/A615M, Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inch.
  - 2. Welded Wire Fabric: ASTM A185 where applicable for wet cast units.
- H. Provide anchors, dowels and other anchoring devices that are standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 304.

## 2.3 COLOR AND FINISH

- A. Match existing on-site section marker posts and benches.
- B. Provide fine-grained texture similar to natural stone, for surfaces intended to be exposed to view. Air voids are not permitted in excess of 1/32 inch, and the density of such voids must be less than 3 occurrences per any 1 inch<sup>2</sup>. Air voids are not permitted when obvious under direct daylight illumination at a 5 foot distance.
- C. Units must exhibit a texture of no less quality than the approved sample when viewed under direct daylight illumination at a 10 foot distance.
- D. Units to comply with ASTM D2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
  - 1. Total color difference – not greater than 6 units.
  - 2. Total hue difference – not greater than 2 units.
- E. Chipping on edges or surfaces of caps, where they will be visible in the final installation, whether resulting from shipment, delivery or other factors or causes is not acceptable, and the units must be removed and replaced with new units at no expense to the Government. For sign posts, minor chips may be allowed if they are not obvious under direct daylight illumination from a 3 foot distance as determined and if approved by the COR.
- F. The occurrence of crazing or efflorescence may constitute a cause for rejection, at the sole discretion of the COR.
- G. Remove cement film, if required, from exposed surface prior to packaging for shipment.

## 2.4 REINFORCING

- A. Reinforce the units as required by the shop drawings, and prepared under direction of Professional Engineer, for safe handling and structural stress.
  - 1. Reinforcing to be minimum 0.25 percent of the cross section area.

- B. Provide non-corrosive reinforcement where faces exposed to weather are covered with less than 1.5 inch of concrete material. Provide reinforcement with minimum concrete coverage of twice the diameter of the bars.

## 2.5 EMBEDDED ANCHORS AND OTHER INSERTS

- A. Fabricate from stainless steel complying with ASTM A240/A240M, ASTM A276, or ASTM A666, Type 304.

## 2.6 CURING

- A. Cure units in a warm curing chamber 1000°F at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 700°F for 16 hours after casting. Provide additional yard curing at 95 percent relative humidity and 350-degree-days (i.e. 7 days at 500°F or 5 days at 700°F prior to shipping. Protect form-cured units from moisture evaporation with curing blankets or curing compounds after casting.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Check cast stone materials for damage, coloration, finish, crazing, efflorescence, fit and finish prior to installation. Do not set unacceptable units.

## 3.2 SETTING TOLERANCES

- A. Comply with the more stringent tolerances of the Cast Stone Institute<sup>SM</sup> Technical Manual or this Section.

## 3.3 REPAIR AND CLEANING

- A. Repair chips with touchup materials furnished by manufacturer.
- B. Saturate units to be cleaned prior to applying an approved masonry cleaner.
- C. Consult with manufacturer for appropriate cleaners.

### 3.4 INSPECTION AND ACCEPTANCE

- A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute except distance for measuring acceptability to be reduced to 3 feet.

END OF SECTION