

**SECTION 04 72 00
CAST STONE MASONRY**

SPEC WRITER NOTE:

1. Use this section for a building stone manufactured from a mixture of Portland Cement and aggregates to simulate natural stone; generally limestone, and used as unit masonry product such as trim, copings, sills, small panels, belt courses, stools, and quoins.
2. Use Section 03 45 00, PRECAST ARCHITECTURAL CONCRETE, for large units over 600 mm (2 feet) square.
3. Delete between // _____ // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.
4. Investigate use of natural cut stone before cast stone is used.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured concrete units to simulate a natural stone.
- B. Installation of cast stone units.

1.2 RELATED WORK

- A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS
- B. Section 04 05 13, MASONRY MORTARING, Setting and pointing mortar.
- C. Section 04 05 16, MASONRY GROUTING, Setting and pointing mortar.
- D. Section 07 92 00, JOINT SEALANTS, Joint sealant and application.
- E. Section 09 06 00, SCHEDULE FOR FINISHES, Color and texture.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.
- B. Samples:
 1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
 2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.
- C. Shop Drawings:

- 1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
- 2. Setting drawings with setting mark.
- D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.
- E. Submit manufacturers test results of cast stone previously made by manufacturer.
- F. Laboratory Data: 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.

1.4 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 an itemized list of product to support the bill of lading.

1.5 WARRANTY

- A. Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

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. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.
- C. ASTM International (ASTM):
 - A167-99 (R2009).....Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
 - A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18.....	Standard Specification for Concrete Aggregates
C150/C150M-20.....	Standard Specification for Portland Cement
C503/C503M-15.....	Standard Specification for Marble Dimension Stone (Exterior)
C568/C568M-15.....	Standard Specification for Limestone Dimension Stone
C615/C615M-18e1.....	Standard Specification for Granite Dimension Stone
C616/C616M-15.....	Standard Specification for Quartz-Based Dimension Stone
C979/C979M-16.....	Standard Specification for Pigments for Integrally Colored Concrete
C1194-19.....	Standard Test Method for Compressive Strength of Architectural Cast Stone
C1195-19a.....	Standard Test Method for Absorption of Architectural Cast Stone
C1364-19.....	Standard Specification for Architectural Cast Stone.
D2244-16.....	Standard Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.7 QUALITY ASSURANCE

A. The Manufacturer:

1. Must have 5 years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.
2. Must be a member of the Cast Stone Institute.
3. Must have a certified plant (certification by the Cast Stone Institute).

B. Stone setter: Must have 5 years' experience setting cast or natural building stone.

C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 meters squared) delivered to the job:

1. Three (3) field cut cube specimens from each of these sample shall 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.

2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.
4. Manufacturer shall 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 shall not deviate by more than + 1/8 inch (3 mm) from approved dimension.
- B. Length of units shall not deviate by more than length /360 or + 1/8 inch (3mm), whichever is greater, not to exceed + 1/4 inch (6 mm). Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.
- C. Warp bow or twist of units shall not exceed length/360 or + 1/8 inch (3 mm), 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 (3 mm), on unformed sides of unit, 3/8 inch (9 mm) maximum deviation.

SPEC WRITER NOTE:

Mock-ups should only be required for large-scale work. Consider allowing mock-up to be a part of finished work.

1.9 MOCK-UP

- A. Provide full size unit(s) for use in construction of sample wall. The mock-up becomes the standard of workmanship for the project.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

- A. Comply with ASTM C 1364
- B. Physical properties: Provide the following:
 1. Compressive Strength - ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
 2. Absorption - ASTM C 1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.

3. Air Content - ASTM C173 or C231, for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
 4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5 percent after 300 cycles of freezing and thawing.
 5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065 percent.
- C. Job site testing - One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 cubic meters) delivered to the job site:
1. Three (3) field cut cube specimens from each of these samples shall 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 allowed by ACI 318.
 2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
 3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.2 RAW MATERIALS

- A. Portland cement - Type I or Type III, white and/or grey, ASTM C 150.
- B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.
- C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
- D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.
- E. Admixtures- Comply with the following:
 1. ASTM C 260 for air-entraining admixtures.
 2. ASTM C 494/C 495 M 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, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
 4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.

5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water - Potable

G. Reinforcing bars:

1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inch (37 mm).

2. Welded Wire Fabric: ASTM A 1064 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

A. Match sample on file.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 inch (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 inch (25 mm) and not obvious under direct daylight illumination at a 5 feet (1.5 meters) distance.

C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 feet (3 meters) distance.

D. ASTM D 2244 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.

2.4 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

1. Minimum reinforcing shall be 0.25 percent of the cross section area.

B. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5inch (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

C. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20 foot (6 meter) distance.

- D. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.
- E. Remove cement film, if required, from exposed surface prior to packaging for shipment.

2.5 CURING

- A. Cure units in a warm curing chamber 100 degrees F (37.8 degrees C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70 degrees F (21.1 degrees C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 50 degrees F (10.0 degrees C) or 5 days @ 70 degrees F (21.0 degrees C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

- A. Comply with Cast Stone Institute Technical Manual.
- B. Set stones 1/8 inch (3 mm) or less, within the plane of adjacent units.
- C. Joints, plus - 1/6 inch (1.5 mm), minus - 1/8 inch (3 mm).

3.3 JOINTING

- A. Joint size:
 1. At stone/brick joints 3/8 inch (9.5 mm).
 2. At stone/stone joints in vertical position 1/4 inch (6 mm) (3/8 inch (9.5 mm) optional).
 3. Stone/stone joint exposed on top 3/8 inch (9.5 mm).
- B. Joint Materials:
 1. Mortar, Type N, ASTM C 270.
 2. Use a full bed of mortar at all bed joints.
 3. Flush vertical joints full with mortar.
 4. Leave all joints with exposed tops or under relieving angles open for sealant.
 5. Leave head joints in coping and projecting components open for sealant.
- C. Location of joints:
 1. As shown on shop drawings.
 2. At control and expansion joints unless otherwise shown.

3.4 SETTING

- A. Drench units with clean water prior to setting.
- B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
- C. Set units in full bed of mortar, unless otherwise detailed.
- D. Rake mortar joints 3/4 inch (18 mm) for pointing.
- E. Remove excess mortar from unit faces immediately after setting.
- F. Tuck point unit joints to a slight concave profile.

3.5 JOINT PROTECTION

- A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.
- B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 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.

3.7 INSPECTION AND ACCEPTANCE

- A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

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