

**SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A The work performed under this section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete caps for columbarium units, with supports, anchors, and attachments, perimeter joint sealants, and grouting under panel.

1.2 REFERENCES

Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.

- A ACI 301 - Specifications for Structural Concrete for Buildings.
- B ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 523 - Guide for Low Density Precast Concrete
- D. ASTM A 36/A36M - Carbon Structural Steel.
- E. ASTM A 123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
- F. ASTM A 185 - Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
- G ASTM A 307 - Carbon Steel Bolts and Studs, 60,000 Pounds per square inch Tensile Strength.
- H. ASTM A 325/A325 - High Strength Bolts for Structural Steel Joints.
- I. ASTM A 767/A767M - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
- J. ASTM A 775/A775M - Epoxy Coated Reinforcement Steel Bars.
- K. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field.
- L. ASTM C 33 - Concrete Aggregates.
- M. ASTM C 150 - Portland cement.

- N. ASTM C 260 - Air-Entraining Admixtures for Concrete.
- O. ASTM C 330 - Lightweight Aggregates for Structural Concrete.
- P. AWS D1.1 - Structural Welding Code. PCI MNL-117 - Manual for Quality Control for Plants and Production of
- Q. AWS D1.4-Structural Welding code, Reinforcing Steel
- R. PCI MNL-117 – Manual for Quality Control for Plants and Production of Architectural Precast concrete Products.
- S. PCI MNL-120 - Design Handbook - Precast and Pre-stressed Concrete.
- T. PCI MNL-122 - Architectural Precast Concrete.
- U. PCI MNL-123 - Manual on Design of Connections for Precast Pre-stressed Concrete.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with PCI MNL 117, PCI MNL-120m OCU NBK-122, PCK MNL-123 and ACI 318..
- B. Welding: AWS D1.1 and AWS D1.4
- C. Fabricator Qualifications: Company specializing in performing work of this section with minimum three (3) years documented experience with sufficient production capacity to produce and deliver required units without causing delay in work.
 - 1. Fabricating plant shall be certified by one of the following:
 - a. Architectural Precast Association (APA)
 - b. Precast/Pre-stressed Concrete Institute (PCI), Group A1,
 - c. Or Equal certification program.
- D. Installer Qualifications: Installer shall have a record of at least three (3) years of documented experience with sufficient installation capacity to install required units without causing delay in work.
- E. Design units under direct supervision of a professional engineer experienced in design of this work and licensed at the place where the Project is located.
- F. Welder Qualifications: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4 at the place where the Project is located.

1.4 DESIGN REQUIREMENTS

- A. Design units to withstand actual loads such as wind, suction, deflection, and thermal movement loads.

- B. Design component connections to accommodate structure movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

1.5 SUBMITTALS

- A. Shop (Erection) Drawings: Detail fabrication and installation of units, indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials.
- B. Samples: submit two panels, 24-in x 24-in in size illustrating surface finish, color, and texture.
- C. Welding Certificates: Copies of certificates for welding procedure specifications (WPS) and personnel.
- D. Qualification Data for fabricator and professional engineer: List of completed projects with project names and addresses, names and addresses of RE/COTRs and owners, and other information specified.
- E. Concrete strengths and mix designs
- F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
 - 1. Concrete materials.
 - 2. Reinforcing materials.
 - 3. Admixtures.
 - 5. Structural-steel shapes
 - 6. Anchors.

1.6 MOCK-UP

- A. For 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.
- B. Include mock-up panel with typical reveals, joints, numbering and lettering and sealants.
- C. Locate mock-up where directed.
- D. Mock-up may remain as part of the Work.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Product handling requirements of PCI MNL 117 shall be followed at the plant and project site.
- B. Deliver all units to the project site in such quantities and at such times to assure compliance with the agreed project schedule and proper setting sequence so as to limit unloading units temporarily on the ground.
- C. Lift and support units only at designated points shown on the Shop Drawings.
- D. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.
- E. Carefully handle, transport, and store precast members to prevent damage of any kind. Broken, chipped, stained, or damaged units will be subject to rejection unless permission to repair such defects is obtained in writing from the Owner's designated representative.
- F. Units damaged after erection shall be either repaired or replaced as determined by the Owner's designated representative. No repairs shall be made until the damaged unit has been examined by the Owner's designated representative and a proposed repair procedure has been submitted to, and accepted by, the Owner's designated representative in writing. The Owner's designated representative may require that repairs be made by the manufacturer. Costs for repair work shall be borne by the Contractor.
- G. Cover precast units to protect from soiling or damage by subsequent construction operations, using reinforced building paper or other material acceptable to the Owner's designated representative.

1.8 WARRANTY

- A. Warranty of precast concrete work, including anchorage, joint treatment and related components to be free from defects in materials and workmanship, including cracking and spalling.
- B. After erection, completed work will be weather-tight, subject to terms of Article "Warranty of Construction" FAR clause 52.246-21, except warranty period is extended to five years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Materials:

1. Portland Cement: Complying with ASTM C 150, Type I or III, white or gray colors 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.
2. Aggregates: Complying with ASTM C 33, gradation may differ to achieve desired finish characteristics. Select coarse and fine Aggregate colors and screen sizes to match approved sample(s). Verify that adequate supply, from one pit or quarry, for each type of Aggregate is available for the entire Project. If possible obtain entire Aggregate supply prior to starting Work, or have Aggregate supply held in reserve by Aggregate supplier.
3. Lightweight Aggregate: Complying with ASTM C 330.
4. Water: Potable. Clean, clear, and free from deleterious amounts of salts, acids, alkalis, organic materials, oils, detergents, or other matter that may interfere with color, curing, or strength of concrete.
5. Admixtures: Select to be compatible in specified mix.
 - a. Air Entraining: Complying with ASTM C 260.
 - b. Water Reducing: Complying with ASTM C 494, Type A, B, C, F or
 - c. Silica Fume: Complying with ASTM C 1240, for cement replacement for high performance concrete.
 - d. Coloring Agent: Complying with ASTM C 979, compatible with other concrete materials.
 - e. Other constituents: Integral water repellents and other chemicals for which no ASTM standard exists, shall be previously established as suitable for use in concrete or shall be shown by test or experience not to be detrimental to the concrete. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; non-reactive with concrete and suitable for producing required finishes:

B. Formwork:

1. Provide forms with acceptable form facing materials that are non-reactive with concrete or form release agents and will produce required finish surfaces.
2. Construct and maintain forms to produce precast concrete units of shapes, lines, and dimensions indicated, within specified tolerances.

C. Reinforcing Materials:

1. Epoxy Coated Reinforcing Bars: Complying with ASTM A 934; use in special applications where indicated.

D. Connection Materials:

1. Steel Shapes and Plates: Complying with ASTM A 36/A 36M.
2. Carbon Steel Plates: Complying with ASTM A 283/A 283M.
3. High Strength, Low Alloy Structural Steel: Complying with ASTM A 572.

4. Anchor Bolts: Complying with ASTM A 307, carbon steel or ASTM A 325 (ASTM A325M), high strength; bolts nuts, and washers.
5. Welded Headed Studs: Complying with AWS D1.1/D1.3M, Type B.
6. Deformed Steel Wire Bar Anchors: Complying with ASTM A 496.
7. Stainless Steel Plate exposed to weather in final assembly: Complying with ASTM F 593, Type 304 or Type 316; bolts and studs, nuts and washers.
8. Finish for Steel Connection Materials:
 - a. Hot-dip galvanize steel exposed to weather in final assembly complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
 - b. Shop Prime Remaining Steel Shapes: Complying with SSPC Paint 25.
 - c. Anchor Bolts, Nuts, Washers, Cadmium Plated: Complying with ASTM A 563, Grade C. / Form Liners: Units of face design, texture, arrangement, and configuration indicated.
 - d. Hot-dip galvanize setting bolts or projecting steel in masonry applications complying with ASTM A 153/A 153M.
 - e. Galvanizing Repair Paint: Complying with DOD P-21035A or SSPC Paint 20.
 - f. Welding Electrodes: Comply with AWS Standards.

E. Grout Materials:

1. Cement Grout: Cement complying with ASTM C 150; sand complying with ASTM C 404; proportions 1:2.5 by volume, minimum water for placement and hydration.
2. Non-Shrink Grout: Complying with ASTM C 1107.
3. Epoxy Grout: Consult Suppliers.

2.2 MIXES

- A. Design mixes for each type of concrete specified shall be prepared by an independent testing agency or by an architectural precast manufacturing plant at precast manufacturer's option.
- B. Proportion mixes by either testing agency trial batch or field test data methods in accordance with ACI 211.1, using materials to be used on the Project, to provide concrete with properties as follows:
 1. Concrete Density: Normal weight.
 2. Compressive Strength: 5,000 psi (35 MPa) when tested in accordance with ASTM 39/C 39M.
 3. Maximum water cement ratio 0.40 at point of placement.
 4. Add air-entrainment admixture to result in air content at point of placement complying with ACI 533R requirements (5 to 7 percent).
 5. Water absorption maximum 6% (by weight) when tested in accordance with ASTM C642

2.3 FABRICATION

- A. General:

1. Fabricate precast concrete units with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances as specified in PCI MNL-117 or ACI 533R, unless more stringent requirements are shown or specified.
 2. Fabricate units straight, smooth and true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated.
- B. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
- C. Cast openings larger than 10 inches (254 mm) in any dimension according to locations shown on Shop Drawings. Smaller holes may be field cut when approved by COR.
- D. Reinforcement: Comply with CRSI Manual of Standard Practice, PCI MNL-117, or ACI 533R recommendations. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses, and to comply with specified performance criteria.
- E. Cast-in Items: Provide embedded anchors, inserts, steel shapes, and lifting devices as shown on reviewed Shop Drawings. Firmly hold cast items in place by jigs, strong backs, or other approved means.
- F. Locate hoisting devices to permit removal after erection.
- G. Comply with PCI MNL-117 or ACI 533R requirements for measuring, mixing, transporting, and placing concrete. Place facing mix to a thickness of the greater of 1 inch (26 mm) or 1.5 times the maximum Aggregate size. Place back-up concrete to ensure bond with face concrete.
- H. Consolidate concrete using equipment and procedures complying with PCI MNL- 117 or ACI 533R.
- I. Permanently mark units with pick-up points as shown on reviewed Shop Drawings. Imprint casting date and piece mark on a surface to be concealed from view in the finished structure. Imprint should be flush with finished surface without any surface deformation with no raised or embossed effects.
- J. Cure concrete in accordance with PCI MNL-117 or ACI 533R requirements to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- K. Discard units that are warped, cracked, broken, spalled, stained, or otherwise defective. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired or patched area is ultimately concealed by other in-place work.
- L. Manufacturing Tolerances: Fabricate to tolerances listed in PCI MNL-117 or ACI 533R.
- M. Maintain plant records and quality control program during production of precast units. Make records available upon request.

- N. Maintain consistent quality during manufacture.
- O. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
- P. Weld steel fabrications in accordance with AWS D1.1. Weld reinforcing steel in accordance with AWS D1.4. Do not tack weld reinforcing.

2.4 FINISH - PRECAST UNITS

- A. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and have smooth cut stone appearance. Smooth surface finish free from pockets, sand streaks, honeycomb, with uniform color and texture. Bug holes are not permitted.
- B. Finish Exposed Back Surface of Units:
 - 1. To match face surface of units.
- C. Finish unexposed surfaces of units by steel trowel finish.

2.5 FINISH - SUPPORT DEVICES

- A. Clean surfaces of rust, scale, grease, and foreign matter.
- B. Galvanize after fabrication to 2 ounces per square foot in accordance with ASTM A 123.

2.6 FABRICATION TOLERANCES

- A. Maximum Out of Square: 1/8-inch in 10 feet, noncumulative.
- B. Variation From Dimensions Indicated on shop drawings: Plus or minus 1/8-inch.
- C. Maximum Misalignment of Anchors, Inserts, Openings: 1/8-inch.
- D. Maximum Bowing of Units: Length of bow, 360.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Provide testing and analysis of concrete mix.
- B. Take three concrete test cylinders for every ten cubic yards of concrete placed in accordance with ASTM C 31.
- C. Take two slump tests for every six test cylinders in accordance with ASTM C 143.
- D. Take one air entrainment test cylinders for each set of exterior concrete test cylinders taken.
- E. Take water absorption test in accordance with PCI MNL-117.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that building structure, anchors, devices, and openings are ready to receive work of this Section.

3.2 PREPARATION

3.1 PREPARATION

- A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.3 ERECTION

- A. Erect units without damage to shape or finish. Replace or repair damaged panels.
- B. Erect unit level and plumb within allowable tolerances.
- C. Align and maintain uniform horizontal and vertical joints as erection progresses.
- D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Contracting Officer's Technical Representative.
- E. Fasten and Weld units in place. Perform welding in accordance with AWS D1.1.
- F. Touch-up field welds and scratched or damaged galvanized surfaces.
- G. Weld reinforcing steel in accordance with AWS D1.4. Do not tack weld reinforcing.
- H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.
- I. Exposed Joint Dimension: 1/2-inch.
- J. Install sign posts and collars in accordance with Section 10 14 26 - Site Signage.

3.4 ADJUSTING

- A. Adjust units so that joint dimensions are within tolerances.
- B. Protect ALL existing elements including niche covers, walls, sidewalks, and other pertinent infrastructures within the project.

3.5 CLEANING

- A. Clean exposed surfaces of units after erection if soiled or stained.
 - 1. Wash and rinse according to architectural precast concrete manufacturer's recommendations. Protect other work from damage while cleaning.
 - 2. Do not use cleaning materials or methods that change the appearance of architectural precast concrete finishes. Test clean a small area to verify adequacy and safety of materials and methods.
 - 3. Apply a commercially water repellents recommended by precast manufacturer.

END OF SECTION