

JCF Architectural Precast Concrete Standard Specifications

Section 03450 governs the specifications for the manufacturing of precast. Johnson County Foam, Inc. – APC Division complies with the following specifications.

Section 03450 PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural precast concrete wall panels.
2. Supports, anchors, and attachments.
3. Grouting under panels.

B. Related Sections include the following:

1. Section 03450 – Precast Architectural Concrete.
2. Section 042000 – Unit Masonry.

1.2 REFERENCES

A. American Concrete Institute:

1. ACI 318 - Building Code Requirements for Reinforced Concrete; 2011.

B. ASTM International:

1. ASTM A 36 - Standard Specification for Carbon Structural Steel; 2001.
2. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot Dip) on iron and Steel Hardware; 2002.
3. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 2002.
4. ASTM A 563 - Standard Specification for Carbon and Alloy Nuts; 2000.
5. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2001b.
6. ASTM A 767/A 767M - Standard Specification for Zinc-Coated (Galvanized) Bars for Concrete Reinforcement; 2000b.
7. ASTM C 33 - Standard Specification for Concrete Aggregates; 2002a.
8. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2001.
9. ASTM C 150 - Standard Specification for Portland Cement; 2002a.
10. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2001.
11. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete; 1999.

C. Precast/Prestressed Concrete Institute:

1. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 1996.
2. PCI MNL-120 – PCI Design Handbook – Precast and Pre-stressed Concrete; 2010, Seventh Edition.
3. PCI MNL- 122 – Architectural Precast Concrete; 2017, Third Edition.
4. PCI MNL- 123 – Design and Typical Details of Connections of Precast and Pre-stressed Concrete; 1988, Second Edition.
5. PCI MNL- 135 – Tolerance Manual for Precast and Pre-stressed Concrete Construction; 2000.

1.3 SUBMITTALS

A. Product Data: For each product indicated. Retain quality control records and certificates of compliance for 5 years after completion of structure.

B. Mix Design: Proposed concrete mix design for each type and color of concrete mix required including backup mix.

C. Shop Drawing:

1. Indicate separate face and backup mixture locations and thicknesses.
2. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
3. Indicate plans and/or elevations showing unit location and dimensions, erection sequences, and bracing plan for special conditions.
4. Indicate location of each architectural precast concrete unit by same identification mark placed on unit.
5. Indicate relationship of architectural precast concrete units to adjacent materials.
6. Indicate locations and details of stone veneer-facings, stone anchors, and joint widths.
7. Coordinate and indicate openings and inserts required by other trades.
8. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Architect and submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples: Design reference samples for initial verification of design intent, approximately 12 x 12 x 2 in. (300 x 300 x 50 mm), representative of finishes, color, and textures of exposed surfaces of architectural precast concrete units.

E. Qualification Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Included below is a list of completed projects with project names and addresses.

1. Marine Research; Perimeter Landscape – 1000 30th Ave, Gulf Port, LA 39501
2. Madison Ridgeland Academy – 7601 Old Canton Rd, Madison, MS 39110
3. St. Gabriel Catholic Church – 110 St. Gabriel Way, McKinney, TX 75071

F. Material Test Reports: Submit material certificates signed by manufacturer.

1. Concrete materials:
 - a. Compressive Strength – ASTM C39 / ASTM C192
 - b. Absorption.
 - c. Slump – ASTM C143
 - d. Unit Weight – ASTM C138

- e. Air Content; Pressure Method – ASTM C231
- 2. Aggregates – ASTM C33:
 - a. Sieve Analysis – ASTM C136
 - b. Moisture Content – ASTM C566
 - c. Coarse Aggregate – ASTM C561
- 3. Admixtures:
 - a. Air-entraining Admixtures – ASTM C260
 - b. Other Admixtures – ASTM C494
- 4. Curing Materials – ASTM C309:
 - a. Sheet Materials ASTM C171
- 5. Water – ASTM C109

G. Material Certificates: For the following items signed by manufacturer.

- 1. Cementitious Materials – ASTM C150
- 2. Reinforcing Materials – ASTM A615
- 3. Admixtures – ASTM C494
- 4. Pigments and Pigmented Admixtures – ASTM C979

1.4 QUALITY ASSURANCE

- A. Fabricator's Qualifications: A firm that complies with the following requirements and is experienced in producing architectural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Assumes responsibility for architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings.
 - 2. Has sufficient production capacity to produce required units without delaying the work.
- B. Testing Agency Qualifications: An independent testing agency, qualified according to ASTM C 1077 and ASTM E 329 to conduct testing indicated.
- C. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, PCI Design Handbook – Precast and Prestressed Concrete, applicable to types of architectural precast concrete units indicated.
- D. Mockup: Provide a mock-up for evaluation of surface finishes and workmanship.
 - 1. Provide initial production units for job-site assembly with other materials for approval.
 - 2. Coordinate type and location of mock-ups with project requirements. Accepted units will be used as the standard for acceptance of production units. Remove and replace units which are not accepted.
 - 3. Do not proceed with remaining work until workmanship, color, and finish are approved by Architect.
 - 4. Approved mockups may become part of the completed work if undamaged at the time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping, or other physical damage.
- B. Place stored units so identification marks are clearly visible, and units can be inspected.

- C. Deliver architectural precast concrete units in such quantities and at such times to ensure compliance with the agreed project schedule and proper setting sequence and also to limit unloading units temporarily on the ground or other rehandling.
- D. Support units during shipment on non-staining shock-absorbing material.
- E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that could cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Johnson County Foam, Inc., 565 Airport Drive, Mansfield, TX 76063 Tel: (817) 477-5061, Fax: (817) 473-4734. Email: Krissy@JCFCompanies.com Website: www.jcfcompanies.com

2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 40 [Grade 420] ASTM A 706/A 706M, deformed bars, ASTM A 767/A 767M Class II zinc-coated, hot-dip galvanized and chromate wash treated after fabrication and bending.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 [Grade 420] ASTM A 706/A 706M, deformed bars, ASTM A 775/A 775M (or) ASTM A 934/A 934M epoxy coated.

2.4 CONCRETE MATERIALS

- A. Portland Cement: Complying with ASTM C 150, Type I or III, white or gray colors to achieve desired finish colors.
 - 1. For surfaces exposed to view in finished structure, use **(gray) (or) (white)**, of same type, brand, and mill source throughout the precast concrete production.

- B. Normalweight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Provide and stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - 1. Face-Mixture Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
- C. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and non-fading.
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with ASTM C 1602/C 1602M and chemical limits of PCI MNL 117.
- E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1/ D1.1 M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- B. Carbon-Steel Plate: ASTM A 283/A 283M
- C. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M
- D. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or C (ASTM F 568M, Property Class 4.6) carbon- steel, hex-head bolts and studs; carbon-steel nuts (ASTM A 563/A 563M, Grade A); and flat, unhardened steel washers (ASTM F 844).
- E. High-Strength Bolts and Nuts: ASTM A 325/A 325M or ASTM A 490/A 490M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A 563/A 563M) and hardened carbon-steel washers (ASTM F 436/F 436M).

2.6 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
 - 1. Lubricate threaded parts of stainless-steel bolts with an anti-seize thread lubricant during assembly.
- C. Stainless-Steel Headed Studs: ASTM A 276 with the minimum mechanical properties for studs of PCI MNL 117, Table 3.2.3.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures to match Architect's sample or for each type of precast concrete required.

- B. Limit use of fly ash to 20 to 40% replacement of portland cement by weight; ground granulated blast-furnace slag to 15 to 25% of portland cement by weight; and metakaolin and silica fume to 10% of portland cement by weight.
 - 1. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast concrete plant personnel at architectural precast concrete fabricator's option.
 - 2. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested in accordance with ASTM C 1218/C 1218M.
- C. Normalweight Concrete Face and Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normalweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
 - 2. Release Strength: As required by design.
 - 3. Maximum Water-Cementitious Materials Ratio: 0.45.
- D. Water Absorption: 6% by weight or 14% by volume, tested according to PCI MNL 117.
- E. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
 - 2. Release Strength: As required by design.
 - 3. Unit Weight: Calculated equilibrium unit weight of 115 lb/ft³ (1842 kg/m³), where variations exceed plus or minus 5 lb/ft³ (80 kg/m³) adjust to plus or minus 3 lb/ft³ (48 kg/m³), according to ASTM C 567.
 - 4. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
 - 5. When included in design mixtures, add other admixtures to concrete according to manufacturer's written instructions.

2.8 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations and temperature changes, and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.

2.9 FABRICATION

- A. 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.
- B. Fabricate units straight, smooth and true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated.

- C. Cast openings larger than 10 inches (254 mm) in any dimension according to locations shown on Shop Drawings. Do not drill or cut opening or prestressing strand without of Architect's approval. Smaller holes may be field cut when approved by Architect.
- 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. Window connections are best made by field drilled inserts. Firmly hold cast items in place by jigs, strongbacks, or other approved means.
- F. 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.
- G. Consolidate concrete using equipment and procedures complying with PCI MNL-117 or ACI 533R.
- H. 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.
- I. Cure concrete in accordance with PCI MNL-117 or ACI 533R requirements.
- J. Discard units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by the Architect and meet specified requirements. Refer to ACI- 533R for product finish requirements unless otherwise shown or specified.
- K. Manufacturing Tolerances: Fabricate to tolerances listed in PCI MNL-117 or ACI 533R.

2.10 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units of shapes, lines and dimensions indicated, so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in item.

2.11 FINISHES

- A. Finish exposed surfaces or units to match Architect's design reference sample.
- B. Finish exposed surfaces or units in accordance with the following:
 - 1. Smooth surface finish free from pockets, sand streaks, honeycomb, with uniform color and texture. State whether bugholes less than 5/8 inch (16 mm) in diameter are acceptable.
- C. Textured surface finish from form liners or inserts.
- D. Machine textured finish, using power or hand tools to remove matrix and fracture coarse aggregate.
- E. Retarded finish, using chemical retarding agents applied to forms, with washing and brushing procedures to expose aggregate and surrounding matrix.
- F. Abrasive blast finish, using abrasive grit, equipment, application and cleaning procedures to expose aggregate and surrounding matrix.

- G. Acid etched finish using acid solution and application techniques to expose aggregate and surrounding matrix.
- H. Honed or Polished finish using mechanical abrasion, followed by filling and rubbing procedures.
- I. Sand embedment finish, using selected coarse aggregate placed in a sand bed in the bottom of the mold, with sand removed after removal from the mold.
- J. Applied material finish, using selected ceramic or natural stone materials, specified in Section 04400.
 - 1. Finish Exposed Back Surface of Units:
 - a. To match face surface of units.
 - b. By smooth, steel trowel finish.
- K. Finish unexposed surfaces of units by float finish or as-cast form finish.

2.12 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete also test and inspect according to PCI TR-6 "Interim Guidelines for the Use of Self-Consolidating Concrete."
- B. Inspect and test architectural precast concrete in accordance with PCI MNL-117 or ACI 533R.
- C. The Owner may retain an independent Testing Laboratory to evaluate manufacturer's quality control and testing methods. Testing Laboratory shall be certified by CCRL or similar National authority. Manufacturer shall allow Testing Laboratory access to all operations pertinent to the Project.
- D. Defective Work: Architectural precast concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable. Chipped, spalled, or cracked units may be repaired, if repaired units match the visual mock-up. The Architect reserves the right to reject any unit if it does not match the accepted sample panel or visual mock-up. Replace unacceptable units with precast concrete units that comply with requirements.

END OF SECTION 03450