

SECTION 03451

ARCHITECTURAL PRECAST CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural precast concrete wall panels; with integral insulation.
- B. Supports, anchors, and attachments.
- C. Intermediate and perimeter joint seals.
- D. Grouting under panels.

1.02 RELATED REQUIREMENTS

- A. Section 03300 - Cast-in-Place Concrete: Admixtures.
- B. Section 07212 - Board and Batt Insulation: Integral Insulation.
- C. Section 07900 - Joint Sealers: Perimeter joints with sealant and backing.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- F. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- G. ASTM C 33 - Standard Specification for Concrete Aggregates; 2008.
- H. ASTM C 150 - Standard Specification for Portland Cement; 2007.
- I. ASTM C 1088 - Standard Specification for Thin Veneer Brick Units Made From Clay or Shale; 2009.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010.
- K. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2005.
- L. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; Precast/Prestressed Concrete Institute; 2005.
- M. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; Sixth Edition, 2004.
- N. PCI MNL-122 - Architectural Precast Concrete; Precast/Prestressed Concrete Institute; 2007, Third Edition.

- O. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; 1988, Second Edition.
- P. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; Precast/Prestressed Concrete Institute; 2000.

1.04 DESIGN REQUIREMENTS

- A. Design units to withstand design loads as calculated in accordance with 2009 Edition of the Chicago Building Code (CBC), and erection forces. Calculate structural properties of units in accordance with ACI 318.
- B. Design units to withstand static loads and anticipated dynamic loading, including positive and negative wind loads and thermal movement loads.
- C. Design units to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- D. Design component connections to accommodate building movement and thermal movement. Provide adjustment to accommodate misalignment of structure without unit distortion or damage.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's information on accessory products, including, facing brick, pigments, admixtures, inserts, plates, etc.
- C. Shop Drawings: Indicate layout, unit locations, configuration, reveal joints, joist-beam pocket locations, top of panel joist bearing details, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.
 - 1. Include details of mix designs.
 - 2. Include details of brick materials.
 - 3. Include structural design calculations.
- D. Fabricator qualifications. PC erection drawings and calculations to be signed and sealed by an Illinois Licensed Structural Engineer.

1.06 QUALITY ASSURANCE

- A. Perform the work of this section in accordance with PCI MNL-117, PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318. Perform welding in accordance with AWS D1.1.
- B. Fabricator Qualifications:
 - 1. Firm having at least 2 years of documented experience in production of precast concrete of the type required.
- C. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Licensed Structural Engineer experienced in design of precast concrete and licensed in the State of Illinois.
- D. Welder: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handling: Lift and support precast units only from support points.
- B. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Precast Concrete:
 - 1. Dukane.
 - 2. Edwards Precast.
 - 3. ATMI.
 - 4. Substitutions: See Section 01600 - Product Requirements.

2.02 PRECAST UNITS

- A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
 - 1. Concrete Face Mix: Minimum 5000 psi, 28 day strength, air entrained to 4 to 6 percent; comply with ACI 301.
 - 2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
 - 3. Calculate structural properties of units in accordance with ACI 318.
 - 4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - 5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.
- B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.
- C. Finish Type D: Thin brick veneer. Remove excess concrete from joints and faces of thin brick units. Protect adjacent surfaces.

2.03 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M Grade 40 (280).
- B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.

2.04 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal Portland type.
- B. Fine and Coarse Structural Aggregates: ASTM C 33.
- C. Grout:
 - 1. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

2.05 FORM LINERS

- A. Material: Glass fiber reinforced polyester or as required for thin brick panel configurations.

2.06 THIN BRICK

- A. Manufacturers:
 - 1. Metro Brick; Product Thinbrick, Range with Ironspot: www.metrothinbrick.com.
- B. Thin Brick: ASTM C1088.
 - 1. Type: TBX.
 - 2. Size: Manufacturer's standard Utility or Jumbo 3 5/8in. high by 11 5/8in. long..
 - 3. Thickness: not less than 1/2 inch. Not more than 1in.
 - 4. Tolerances: 1/16 inch.
 - 5. Color, texture, range, special shapes: provide "Rustic Ironspot color and texture. Include corners and edge corners, and end corners as required. Submit samples for verification.
 - 6. Protective Coating: coordinate with manufacturer's standard when required by PC manufacturer.

7. Cold water absorption at 24 hours max. 6% when tested per ASTM C67.

8. Efflorescence: Provide brick that has been tested according to ASTM C67 and rate "not effloresced".
9. Out of square: Plus or minus 1/16 in. measured according to ASTM C67.
10. Warpage: Consistent plane of plus 0 in. , minus 1 degree.
11. Variation of shape from specified angle; Plus or minus 1 degree.
12. Tensile Bond Strength; Not less than 150 psi, before and after freeze-thaw testing, when tested per modified ASTM E488. Epoxy steel plate with welded rod on a single brick face for each test.
13. Freeze thaw resistance: No deterioration (spalling, cracking, or chafing) after 300 cycles when tested in accordance with ASTM C666 Method A or B.
14. Modulus of Rupture; Not less than 250 psi per ASTM C650.
15. Chemical Resistance: Provide brick that has been tested according to ASTM C650 and rated "not affected".
16. Surface Coloring; Brick with surface coloring shall withstand 50 cycles of freezing and thawing per ASTM C67 with no observable difference in applied finish when viewed from 20 ft.
17. Back Surface Texture: Scored, Combed, Wire roughened, Ribbed, Keybacked, Dovetailed.

2.07 SUPPORT DEVICES

- A. Connecting and Support Devices: ASTM A 36/A 36M steel; hot-dip galvanized in accordance with ASTM A153/A 153M.
 1. Clean surfaces of rust, scale, grease, and foreign matter.
- B. Primer: Zinc rich type.

2.08 INSULATION

- A. Integral Insulation: Rigid extruded polystyrene insulation, specified in Section 07212.

2.09 ACCESSORIES

- A. Sealant: Elastomeric type specified in Section 07900.

2.10 MIX

- A. Concrete: Minimum 5000 psi, 28 day strength, air entrained to 4 to 6 percent in accordance with ACI 301.

2.11 FABRICATION

- A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.
- B. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
- C. Use form liners in accordance with manufacturer's instructions.
- D. Place thin brick in form liner in accordance with manufacturer's instructions. Mix bricks from several cartons for uniform distribution of color variations.
- E. Maintain consistent quality during manufacture.
- F. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
- G. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.
- H. Cast rigid insulation into units. Cut drainage channels in exterior face of insulation to route moisture to exterior. Position weep drains to suit. Maintain drainage channels clear.
- I. Locate hoisting devices to permit removal after erection.

- J. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- K. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.12 FINISH - PRECAST UNITS

- A. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

2.13 FINISH - SUPPORT DEVICES

- A. Clean surfaces of rust, scale, grease, and foreign matter.
- B. Prime paint in one coat, except surfaces in direct contact with concrete or requiring field welding.

2.14 FABRICATION TOLERANCES

- A. Conform to PCI MNL-117 and PCI MNL-135.

2.15 SOURCE QUALITY CONTROL

- A. Provide testing of concrete mix.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 ERECTION

- A. Erect units without damage to shape or finish. Replace or repair damaged panels.
- B. Erect units level and plumb within allowable tolerances.
- C. Weld units in place. Perform welding in accordance with AWS D1.1.
- D. Touch-up field welds and scratched or damaged primed painted surfaces.
- E. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.
- F. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.
- G. Seal perimeter and intermediate joints in accordance with Section 07900.

3.04 TOLERANCES

- A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.

3.05 ADJUSTING

- A. Adjust units so that joint dimensions are within tolerances.

3.06 PROTECTION OF FINISHED WORK

- A. Provide non-combustible shields during welding operations.

3.07 SCHEDULES

END OF SECTION