

SECTION 03450

PLANT-PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Conditions of the Contract, and Division 1 - General Requirements apply to this Section.

1.2 SUMMARY

- A. Section Includes: Provide plant-precast architectural concrete units.
- B. Related Work:
 - 1. Section 07600 - Flashing and Sheet Metal.
 - 2. Section 07900 - Joint Sealers.

1.3 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements and Performance:
 - 1. Comply with applicable building code requirements and regulations of authorities having jurisdiction, including structural, wind load, and seismic forces.
 - 2. Provide units which will perform under applicable wind loads, dead loads, seismic forces and building dynamics. Building dynamics shall include loads due to thermal stresses, live loads, impact loads, concentrated loads, structural deflection, story drift, and loads encountered during shipping and erection.

1.4 SUBMITTALS

- A. Product Data: Submit product data including concrete, pigments, admixtures, and connection materials.
- B. Samples: Submit samples, nominal size 12 inch by 12 inch by appropriate thickness, of each type of unit and finished facing for approval of quality, color, and texture. Submit prior to fabrication.
- C. Shop Drawings: Submit shop drawings including, but not limited to, the following:
 - 1. Dimensions, finishes, relationships to adjacent materials, and provisions for erection and placement.

2. In-place location of units, fabrication details, plans, elevations, anchorages, reinforcement, connection details and methods.
 3. Show identification marks, coordinated to Shop Drawings, and date of manufacture on all units to facilitate handling and erection.
 4. Provide setting diagrams, templates and directions as required for installation.
- D. Plant Certification: Submit written certification that fabricator's plant is certified by the Architectural Precast Association (APA) or is certified as Group A1 by the Precast/Prestressed Concrete Institute (PCI).
- E. Engineering Calculations: Submit engineering calculations sealed by a structural engineer licensed to practice in the jurisdiction of the Project.
- F. Mix Design: Submit proposed concrete mix design for each type and color of concrete mix required including backup mix.
- G. Material Test Reports: Submit material certificates signed by manufacturer for concrete materials, reinforcing materials, admixtures, and similar items.
- H. Welder's Certification: Submit for each welder.

1.5 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Fabricator shall have a minimum of five years experience in producing units similar to those required for this Project, with sufficient production capacity to produce and deliver required units without causing delay in the Work. Fabricating plant shall be certified by one of the following:
1. Architectural Precast Association (APA).
 2. Precast/Prestressed Concrete Institute (PCI), Group A1.
 3. Applicable municipal building department.
- B. Installer's Qualifications: Installer shall have a record of at least five years of successful installation of units similar to those required for this Project.
- C. Welder's Qualifications: Provide certification that welders to be employed in the Work are certified by AWS and applicable local building officials, and have been re-certified in the last 12 months.
- D. Mock-Ups: Provide initial production units for job-site assembly with other materials for approval. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle precast in strict compliance with fabricator's instructions and recommendations and industry standards. Protect from damage. Lift and support units only at designated lifting points as shown on approved Shop Drawings.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

PART 2 - PRODUCTS

2.1 FABRICATORS

- A. Approved Fabricators: Provide units produced by a fabricator which participates in the Architectural Precast Association's Plant Certification Program for Production of Architectural Precast Concrete Products and is designated as an APA-certified plant; or is certified to Group A1 Certification by the Precast/Prestressed Concrete Institute, or the applicable municipal building department which has an ongoing approval process for certifying fabricators.
- B. List of APA Approved Fabricators: Refer to the current list of approved fabricators provided by the Architectural Precast Association, 6710 Winkler Road, Suite 8, Fort Myers, Florida 33919, telephone 239-454-6869, fax 239-454-6787, or info@archprecast.org, or www.archprecast.org.

2.2 MATERIALS

- A. Concrete Materials:
 - 1. Portland Cement: ASTM C 150, Type I or III, [white] [gray] colors to achieve required 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: ASTM C 33, gradation may differ to achieve required finish characteristics. Select coarse and fine aggregate colors and screen sizes to match approved sample. Verify that adequate supply, from one pit or quarry, for each type of aggregate is available for the entire Project. Obtain entire aggregate supply prior to starting Work or have aggregate supply held in reserve by supplier.
 - 3. Lightweight aggregate: 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 and as follows: Air entraining, ASTM C260; water reducing, ASTM C494 Type A, B, C, F or G; silica fume, ASTM C1240 for cement replacement for high performance concrete; coloring agent, ASTM C979 compatible with other concrete materials.
- B. Formwork: Provide forms with acceptable form facing materials that are non-reactive with concrete or form release agents and will produce required finish surfaces. Construct and

maintain forms to produce precast concrete units of shapes, lines and dimensions indicated, within specified tolerances.

C. Reinforcing Materials:

1. Reinforcing Bars: ASTM A 615, Grade 40 or 60, unless otherwise required to meet structural requirements. Use galvanized reinforcing bars; ASTM A 767, hot-dip galvanized where concrete cover is less than 1-1/2 inches.
2. Steel Welded Wire Fabric: ASTM A 185, plain, cold drawn.
3. Pre-stressing Tendons: ASTM A 416, Grade 250 or 270, uncoated, 7 wire, low relaxation strand.

D. Connection Materials:

1. Steel Shapes and Plates: ASTM A 36.
2. Malleable Iron Castings: ASTM A 47.
3. Carbon Steel Plates: ASTM A 283.
4. High Strength, Low Alloy Structural Steel: ASTM A 572.
5. Carbon Steel Structural Tubing: ASTM A 500, Grade B.
6. Anchor Bolts: ASTM A 307, carbon steel or ASTM A 325, high strength; bolts, nuts, and washers.
7. Welded Headed Studs: AWS D1.1, Type B.
8. Deformed Steel Wire Bar Anchors: ASTM A 496.
9. Stainless Steel Plate: ASTM F 593, Type 304 or Type 316; bolts and studs, nuts and washers.
10. Welding Electrodes: Comply with AWS Standards.

E. Finish for Steel Connection Materials:

1. Hot-Dip Galvanizing: ASTM A 123 or A 153, for steel exposed to weather in final assembly.
2. Shop Prime Remaining Steel Shapes: SSPC-Paint 25. Hot-dip galvanize ASTM A 153 setting bolts or projecting steel in masonry applications.
3. Anchor Bolts, Nuts, Washers: ASTM A 563, Grade C.
4. Galvanizing Repair Paint: DOD-P-21035A or SSPC-Paint 20.

E. Bearing Pads: Elastomeric pads, AASHTO M251; ASTM D 412.

F. Grout Materials:

1. Cement Grout: Cement ASTM C 150; sand ASTM C 404; proportions 1:2.5 by volume, minimum water for placement and hydration.
2. Non-Shrink Grout: ASTM C 1107.

2.3 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 fabricator'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 [normalweight] [lightweight] concrete with properties as follows:
 - 1. Compressive Strength: [5,000 psi] when tested in accordance with ASTM C 39.
 - 2. Maximum water cement ratio 0.40 at point of placement.
 - 3. Air-entrainment admixture to result in air content at point of placement complying with ACI requirements.
 - 4. Water absorption maximum 6% by weight when tested in accordance with ASTM C 642.

2.4 FABRICATION

- A. General: 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. Fabricate units straight, smooth and true to size and shape, with exposed edges and corners precise and square, unless otherwise indicated.
- B. Cast openings larger than 10 inches in any dimension according to locations shown on Shop Drawings. Smaller holes may be field cut.
- C. 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.
- D. Cast-In Items: Provide embedded anchors, inserts, steel shapes, and lifting devices. Firmly secure items in place during casting by jigs, strongbacks, or other approved means.
- E. 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 or 1.5 times the maximum aggregate size unless indicated otherwise. Place back-up concrete to ensure bond with face concrete.
- F. Consolidate concrete using equipment and procedures complying with PCI MNL 117 or ACI 533R.
- G. 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.
- H. Cure concrete in accordance with PCI MNL 117 or ACI 533R requirements.

- I. 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.
- J. Fabrication Tolerances: Fabricate to tolerances listed in PCI MNL 117 or ACI 533R.

2.5 COLOR AND FINISHES

- A. Color: [White][Black] [Gray] [Brown/tan] [Yellow/buff] [Red/pink] Green] color range as illustrated at the Architectural Precast Association website, www.archprecast.org/color.htm.
- B. Finish: [Match approved reference sample.] [Smooth finish, as cast] [Smooth finish, light sandblast] [Smooth finish, acid etched] [Exposed aggregate, chemically retarded and sandblasted] [Exposed aggregate, chemically retarded and waterwashed] [Exposed aggregate, sandblasted] [Formliner] [Tooled] [Natural stone veneer] [Brick face] [Dry tamp cast stone] [Sand embedment] finish as described at the Architectural Precast Association website, www.archprecast.org/finishes.htm.
- C. Finish of Exposed Back Surface of Units: [Match surface finish.] [Smooth steel trowel finish.]
- D. Finish of Concealed Surfaces: Float finish or as-cast form finish.

2.6 SOURCE QUALITY CONTROL

- A. Inspect and test architectural precast concrete in accordance with PCI MNL 117 or ACI 533R. Producers certified by APA or PCI may conduct their own Quality Control operations with reports to designated authorities.
- B. The Owner may retain an independent Testing Laboratory to evaluate fabricator's quality control and testing methods. Testing Laboratory shall be certified by CCRL or similar national authority. Fabricator shall allow Testing Laboratory access to all operations pertinent to the Project.
- C. Defective Work: Discard units that do not conform to requirements as shown or specified. Replace with units which meet requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation, tolerances, true and level bearing surfaces, and other conditions affecting performance of architectural precast concrete units. Do not proceed with installation until unsatisfactory conditions have been corrected.

- B. Do not install units until supporting structure has been completed and attained allowable design compressive strength.

3.2 ERECTION

- A. Erect units using personnel experienced and trained in placement and securing of architectural precast concrete units. Lift and handle precast using lift points and embeds as shown on precast shop drawings.
- B. Erect level, plumb, and true to line. Do not allow cumulative dimensional errors to develop. Adjustments such as shimming which would place additional stress on units will not be permitted. Adhere to dimensional tolerances in accordance with PCI recommendations. Erect and secure in a manner to prevent damage to units or units in place. Replace damaged units which cannot be successfully repaired.
- C. Erection Tolerances: Erect within tolerances listed in PCI MNL 117, Appendix I or ACI 533R.
- D. Where two stage joint seal is required, sequence with sealant application to ensure that sealant, gaskets, and similar items required for interior side seal are installed concurrently with installation of precast units.

3.3 REPAIR

- A. Repair damaged exposed surfaces of units to match color, texture, and uniformity of surrounding units. Remove and replace damaged units when repairs do not meet requirements.

3.4 CLEANING AND PROTECTION

- A. Clean exposed surfaces of units after erection if soiled or stained.
 - 1. Wash and rinse according to architectural precast concrete fabricator'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 suitability of materials and methods.
- B. Protect finished surfaces from soiling or damage.

END OF SECTION

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