

**SECTION 03 45 00
PRECAST ARCHITECTURAL CONCRETE**

PART 1 - GENERAL

1.1 DESCRIPTION

This section includes the performance criteria, materials, production, and erection of architectural pilaster caps, columbaria cap units. 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 work shown on the contract drawings.

1.2 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Sealants and Caulking: Section 07 92 00, JOINT SEALANTS.
- C. SCHEDULE FOR FINISHES. Note that all architectural precast concrete, finishes and related mortar, caulking, etc. for the products under this section shall match those existing, as determined by the Resident Engineer.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that complies with PCI MNL 117 and the following requirements and is experienced in producing units similar to those indicated for this Project and with a record of successful in-service performance:
 - 1. Has sufficient production capacity to produce required units without delaying the work.
- B. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117.
- C. Pilaster Cap, Columbaria: After color and finish sample approval and before fabricating units, produce a minimum of two full size pilaster caps (for corner pilaster at single sided columbaria units) and four sample wall caps (two for back to back columbaria units and two for memorial walls) for review by Resident Engineer. Wall cap samples to be full width and no less than two feet in length. Incorporate full scale details of architectural features, finishes, textures, drip slot and transitions in the sample caps. Approved samples may be used for mockup and range sample.
 - 1. Locate caps where indicated or, if not indicated, as directed by Resident Engineer.
 - 2. After acceptance of sample caps, maintain one sample cap at the manufacturer's plant and one at the project site in an undisturbed condition as a standard for judging the completed work.

3. Demolish and remove sample caps only when directed by Resident Engineer.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01, GENERAL REQUIREMENTS.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide units and connections capable of withstanding: the design criteria specified on the drawings, self weights and weights of materials supported or attached, for the conditions indicated.
 1. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, applicable to types of units indicated.
 2. Design for handling, transportation and erection stresses.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years or period of warranty, whichever is greater.
- B. Design Mixes: For each concrete mix along with compressive strength and water-absorption tests.
- C. Shop Drawings: Detail fabrication and installation of units.
 1. Indicate member locations with distinctive marks that match marks placed on the panels. Provide plans, elevations, dimensions, corner details, shapes, cross sections and relationships to adjacent materials.
 2. Indicate aesthetic intent including joints, reveals, and extent and location of each surface finish.
 3. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, and connections.
 4. Indicate locations, tolerances and details of anchorage devices to be embedded in or attached to structure or other construction.
 5. Indicate locations and details of facing materials, anchors, and joint widths.
- D. Samples: Design reference samples for initial verification of color and texture design intent, approximately 12 by 12 by 2 inches, representative of finishes, color, and textures of exposed surfaces of units.
- E. Samples for each facing unit required, showing the full range of color and texture expected. Supply sketch of each corner or special shape with dimensions. Supply sample showing color and texture of joint treatment.

- F. Qualification Data for fabricator and professional engineer: List of completed projects with project names and addresses, names and addresses of Resident Engineers and owners, and other information specified.
- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Concrete strengths and mix designs.
- H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements.
 - 1. Concrete materials.
 - 2. Reinforcing materials
 - 3. Admixtures.
 - 4. Bearing pads.
 - 5. Facing units.
 - 6. Anchors.
 - 7. Mortar (to match existing)
 - 8. Caulk (to match existing)

1.6 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. Store units under waterproof covers on planking clear of ground.
- F. Protect from handling, dirt, stain, and water damage.

1.7 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.

1.8 APPLICABLE PUBLICATIONS

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

B. American Society for Testing and Materials (ASTM):

A27/A27M-03.....	Steel Castings, Carbon, for General Application
A36/A36M-04.....	Carbon Structural Steel
A47/A47M-99.....	Ferritic Malleable Iron Castings
A82-02.....	Steel Wire, Plain, for Concrete Reinforcement
A108-03.....	Steel Bar, Carbon and Alloy, Cold-Finished
A123/A123M-02.....	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M-03.....	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A167-99.....	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A184/A184M-01.....	Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
A185-02.....	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A276-04.....	Stainless Steel Bars and Shapes
A283/A283M-03.....	Low and Intermediate Tensile Strength Carbon Steel Plates
A307-03.....	Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
A325/A325M-04.....	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A416/A416M-02.....	Steel strand, Uncoated Seven-Wire for Prestressed Concrete
A490/A490M-04.....	Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
A496-02.....	Steel Wire, Deformed, for Concrete Reinforcement
A497-02.....	Steel Welded Wire Reinforcement, Deformed, for Concrete
A500-03a.....	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A563/A563M-04.....	Carbon and Alloy Steel Nuts
A572/A572M-04.....	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A615/A615M-04a.....	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A666-03.....	Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
A675/A675M-03.....	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
A706/A706M-04a.....	Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A767/A767M-00b.....	Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
A775/A775M-04.....	Epoxy-Coated Steel Reinforcing Bars
A780-01	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
A884/A884M-02.....	Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement
A934/A934M-04.....	Epoxy-Coated Prefabricated Steel Reinforcing Bars
B227-04	Hard-Drawn Copper-Clad Steel Wire
B633-98e1	Electrodeposited Coatings of Zinc on Iron and Steel
C33-03.....	Concrete Aggregates
C40-04.....	Organic Impurities in Fine Aggregate for Concrete
C150-04.....	Portland Cement
C260-01.....	Air-Entraining Admixtures for Concrete
C330-04.....	Lightweight Aggregates for Structural Concrete
C373-88(99)	Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
C494/C494M-01	Chemical Admixtures for Concrete
C618-03.....	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C881/C881M-02	for Epoxy-Resin-Base Bonding Systems for Concrete
C979-99.....	Pigments for Integrally Colored Concrete
C989-04.....	Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
C1017/C1017M-03	Chemical Admixtures for Use in Producing Flowing Concrete
C1107-02.....	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

- C1218/C1218M-99 Test Method for Water-Soluble Chloride in Mortar and Concrete
- C1240-04..... Silica Fume Used in Cementitious Mixtures
- D412-98(02)e1 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D2240-03..... Test Method for Rubber Property—Durometer Hardness
- F436/F436M-03 Hardened Steel Washers
- F568M-02 Carbon and Alloy Steel Externally Threaded Metric Fasteners
- F593-02(04)e1 Stainless Steel Bolts, Hex Cap Screws, and Studs
- F844-00 Washers, Steel, Plain (Flat), Unhardened for General Use

C. American Concrete Institute (ACI):

- ACI 211.1-91 Selecting Proportions for Normal, Heavyweight and Mass Concrete (Reapproved 2002)
- ACI 318/318M-02 (318R/318RM-02) Building Code Requirements for Structural Concrete

D. American Association of State Highway and Transportation Officials:

- AASHTO LFRD-2004 LRFD Bridge Design Specifications, U.S., 3rd Edition
- AASHTO M251-97(R2001) Elastomeric Bearings

E. Precast/Prestressed Concrete Institute (PCI):

- MNL-117-96..... Quality Control for Plants and Production of Architectural Precast Concrete Products
- MNL-120-99..... Design Handbook – Precast and Prestressed Concrete
- MNL-124-89..... Design for Fire Resistance of Precast Prestressed Concrete.
- MNL-127-99..... Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products
- MNL-135-00..... Tolerance Manual for Precast and Prestressed Concrete Construction
- TR-6-03 Interim Guidelines for the Use of Self-Consolidating Concrete

F. Military Specifications (MIL. Spec):

- MIL-C882E-89 Cloth, Duck, Cotton or Cotton-Polyester Blend Synthetic Rubber, Impregnated, and Laminated, Oil Resistant.

G. Structural Steel Painting Council (SSPC):

SSPC-Paint 20 (2002) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).

PART 2 - PRODUCTS

2.1 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; non-reactive with concrete and suitable for producing required finishes:
 - 1. Mold-Release Agent: Commercially produced liquid-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.
- B. Form Liners: Units of face design, texture, arrangement, and configuration as required to produce the finished product. Provide solid backing and form supports to ensure that form liners remain in place during concrete placement. Use with manufacturer's recommended liquid-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.

2.2 REINFORCING MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Weldable Reinforcing Bars: ASTM A706/A706M, deformed.
 - 1. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized and chromate wash treated after fabrication and bending.
 - 2. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M.
- C. Epoxy-Coated-Steel Welded Wire Reinforcement: ASTM A884/A884M Class A coated, plain on flat sheet, Type 1 bendable coating.
- D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I or III. Use white cement with coloring pigments to assure a match to existing precast units.
 - 1. Use same type, brand, and mill source throughout the precast concrete production.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, 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 entire project.

1. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
2. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Resident Engineer.
 - a. Clean washed white sand.
3. Face-Mix Fine Stone Aggregates: Siliceous stone graded to achieve a very fine-grained texture and color to match the exposed finish at existing precast panels and caps. Use marble or granite for polished or tooled surfaces.
 - a. Marble: ASTM C503
 - b. Granite: ASTM C615
 - c. Quartz: ASTM C616
 - d. Limestone: ASTM C568 high density
- C. Lightweight Coarse Aggregate: Except as modified by PCI MNL 117, ASTM C 330, with absorption less than 11 percent and free from expanded clay.
- D. Admixtures: Admixtures containing calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture are not permitted.
 1. Coloring Admixture: ASTM C979, lime-proof synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable and non-fading
 2. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 3. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 4. Retarding Admixture: ASTM C494/C494M, Type B.
 5. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 8. Plasticizing Admixture for Flowable Concrete: ASTM C1017/C1017M.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

2.4 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless steel washers. Lubricate threaded parts of stainless steel bolts with an anti-seize thread lubricant during assembly.

- C. Stainless-Steel Headed Studs: ASTM A276 and bearing the minimum mechanical properties for studs as indicated under PCI MNL 117, Table 3.2.3.
- D. Cramps and Anchors: Bars 3/16-inch by 1-1/4 inch wide.
- E. Lifting Hooks: Stainless Steel Type 304, size for twice the weight of unit.
- F. Adjustable Masonry-Veneer Anchors: Provide 2-piece assemblies allowing vertical or horizontal differential movement between veneer and pilaster or pre-cast columbarium unit parallel to plane of wall but resisting tension and compression forces perpendicular to it, for attachment over cast in place concrete or masonry units.
 - 1. Structural Performance Characteristics: Capable of withstanding a 100-lb. Load in either tension or compression without developing play or deforming more than 0.05 inch.
 - 2. Stainless-Steel Wire: ASTM A 580, Type 304 or 316.
 - 3. Galvanized Steel Sheet: ASTM A 653, G60 (ASTM A 653M, Z180), continuous lines before fabrication.
 - 4. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire-tie section and a metal-anchor section.

2.5 ACCESSORIES

- A. Provide clips, hangers, plastic or steel shims, and other accessories required to install units.

2.6 CONCRETE MIXES

- A. Prepare design mixes to match Resident Engineer's sample for each type of concrete required.
 - 1. Limit use of fly ash and granulated blast-furnace slag to 20 percent replacement of Portland cement by weight.
- B. Design mixes shall be prepared by a qualified independent testing agency or by qualified precast plant personnel at fabricator's option.
- C. 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 C1218/C1218M.
- D. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - 3. Release Strength at Transfer of Prestress: 3500 psi.

- E. Lightweight Concrete Mixes: Proportion mixes 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.
 - 2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu.ft., plus or minus 3 lb/cu.ft., according to ASTM C567.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- G. 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.
- H. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.7 MOLD FABRICATION

- A. Molds: Accurately construct and maintain molds, mortar tight, within fabrication tolerances and of sufficient strength to withstand pressures due to concrete-placement and vibration operations and temperature changes and for pre-stressing and de-tensioning operations.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly radiused.
 - 3. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during placing of concrete.
 - 4. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and pre-stressing tendons by release agent.

2.8 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during pre-casting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement. Weld headed studs and deformed bar anchors used for anchorage.
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in units as indicated.

- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or reinforcing without approval of Resident Engineer.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
 - 1. Place reinforcing steel to maintain at least 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete.
 - 2. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
 - 1. A single design mix throughout the entire thickness of panel.
- G. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117.
- H. Identify pickup points of units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each unit on a surface that will not show in finished structure.
- I. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat.
- J. Minimum Compressive Strength: ASTM C1194, 5000 psi at 30 days. Cure precast a minimum of 30 days before delivery.
- K. Free from cracks, broken edges, marred finish, and loose aggregate.
- L. Facing aggregate matrix not less than 7/8-inch thick when unit is not homogenous.
- M. Maximum Water Absorption: ASTM C1195
 - a. Cold water immersion for 48 hours at 21 degrees C: 5 percent by weight
 - b. Boiling water immersion for 5 hours: 10 percent by weight
- N. Repair damaged units to meet acceptability requirements of PCI MNL 117 and the Resident Engineer.

2.9 FABRICATION TOLERANCES

- A. Fabricate units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

1. Additional Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
 - a. Location of Bearing Surface from End of Member: Plus or Minus 1/4 inch.
- B. Fabricate architectural units, with tolerances meeting PCI MNL 135.
- C. Cap units for columbarium wall units and memorial wall units shall match the length of the wall unit, except at wall spacer locations per the drawings.

2.10 FINISHES

- A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight and sharp. Finish exposed-face surfaces of units to match approved sample panels and as follows:
 1. PCI's "Architectural Precast Concrete –Color and Texture Selection Guide," of plate numbers indicated.
 2. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
- B. Finish unexposed surfaces of units by float finish.

2.11 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to Section 01 45 29, TESTING LABORATORY SERVICES and PCI MNL 117 requirements respectively. If using self-consolidating concrete also test and inspect according to PCI TR-6.
- B. Testing: If there is evidence that the concrete strength of precast concrete units may be deficient, Precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to PCI MNL 117:
 1. Test results will be made in writing on the same day that tests are performed, with copies to Resident Engineer, Contractor, and precast concrete fabricator. Test reports will include the information required in Section TESTING LABORATORY SERVICES and the following:
 - a. Identification mark and type of precast concrete units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- C. Defective or Damaged Work: Units that do not comply with acceptability requirements, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable. Chipped, spalled or cored units may be repaired, if repaired units match the

visual mock-up. The Resident Engineer reserves the right to reject any unit if it does not match the accepted samples and visual mock-up. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Deliver anchorage devices that are embedded in or attached to the structure or foundation before start of such work. Provide locations, setting diagrams, and templates for the proper installation of each anchorage device.
- B. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install units until supporting structure is structurally ready to receive loads from precast.

3.2 ANCHORAGE

- A. Anchor caps to pilasters, columbarium units and memorial wall units with not less than two dowels per cap for single side columbarium units; 4 dowels per cap for back to back columbarium units; and 4 dowels per pilaster cap, as indicated on the Drawings.

3.3 SETTING

Set pre-cast units to comply with requirements indicated on the drawings. Install anchors, supports, fasteners, and other attachments necessary to secure precast in place. Set pre-cast accurately in locations indicated with edges, faces and joints aligned according to established relationships and indicated tolerances.

Maintain uniform joint widths. Lay units with joints as indicated on drawings. Maximum joint width at caps is ½ inch. Centerline and width of cap joints must align with centerline and width of joints between precast columbarium units, except at wall spacer locations, where terminal or corner cap unit will extend over terminal or corner wall spacer to meet the end or corner pilaster, per the drawings. Field verify the required lengths for caps at end or corner wall spacer locations.

- C. Use shim spacers sized for joint thickness in bed joints; not less than two shims per unit.
- D. Tooling:
 - 1. Tool when thumb print hard.
 - 2. Tool bed joints concave.
- E. Sealant Joints:

1. Use sealant and install as specified in Section 07920 - Sealants And Caulking.
2. Rake out vertical joints.
3. Seal vertical joints and wash surface.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet.
- B. Variation from Level: For bed joints and other conspicuous lines, do not exceed 1/4 inch in 20 feet.
- C. Variation in mortar joint thickness: Do not vary from joint size range indicated.

3.5 POINTING

- A. Rake out joints 3/4-inch; clean, wet and pack solid with pointing mortar.
- B. Tool smooth to concave profile.

3.6 PROTECTION

- A. Protect exposed pre-cast during construction.
- B. Cover and protect precast when work is stopped.
- C. Avoid splashing of exposed faces of pre-cast with mortar, immediately removing any spatter with sponge and clean water.
- D. Replace damaged or defective work.

3.7 FIELD QUALITY CONTROL

- A. Refer to Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Testing agency will report test results promptly and in writing to Contractor and Resident Engineer.
- C. Repair or remove and replace work that does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.8 REPAIRS

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.
- D. Remove and replace damaged units when repairs do not meet requirements.

3.9 CLEANING

- A. Clean all surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

- - - END - - -