

SECTION 03400 - PRECAST CONCRETE PANELS

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing all precast concrete units including design, fabrication, delivery, installation and connections, complete, in place, as indicated.
- B. The WORK also requires that one fabricator accept responsibility for furnishing the WORK as indicated but without altering or modifying the CONTRACTOR'S responsibilities under the Contract Documents.
- C. The WORK also includes engineering, field measurements, preparation of submittals, fabrications, finishing, field erection, and sealant.

1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
 - 1. Section 03200 Reinforcement Steel
 - 2. Section 03290 Joints in Concrete Structures
 - 3. Section 03300 Cast-in-Place Structural Concrete
 - 4. Section 03315 Grout
 - 5. Section 07920 Sealants and Caulking

1.3 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
 - 1. Uniform Building Code

1.4 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:
 - 1. ACI 301 Specifications for Structural Concrete for Buildings
 - 2. ACI 315 Details and Detailing of Concrete Reinforcement
 - 3. ACI 318 Building Code Requirements for Structural Concrete
 - 4. ACI 533 Precast Wall Panels
 - 5. AWS A5.4 Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Electrodes
 - 6. AWS B2.1 Welding Procedure and Performance Qualifications

7. AWS D1.1 Structural Welding Code - Steel
8. AWS D1.4 Structural Welding Code - Reinforcing Steel
9. AWS D12.1 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction
10. ASTM A 184 Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
11. ASTM A 185 Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement
12. ASTM A 193 Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
13. ASTM A 194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
14. ASTM A 351 Specification for Steel Castings, Austenitic, for High-Temperature Service
15. ASTM A 497 Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
16. ASTM A 580 Specification for Stainless and Heat-Resisting Steel Wire
17. ASTM A 615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
18. ASTM A 666 Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications
19. ASTM A 775 Specifications for Epoxy-Coated Reinforcing Steel Bars
20. ASTM C 33 Specification for Concrete Aggregates
21. ASTM C 67 Method for Sampling and Testing Brick and Structural Clay Tile
22. ASTM C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate
23. ASTM C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate
24. ASTM C 150 Specification for Portland Cement
25. ASTM C 173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
26. ASTM C 204 Test Method for Fineness of Portland Cement by Air Permeability Apparatus

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| 27. | ASTM C 231 | Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method |
| 28. | ASTM C 260 | Specification for Air-Entraining Admixtures for Concrete |
| 29. | ASTM C 311 | Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete |
| 30. | ASTM C 494 | Specification for Chemical Admixtures for Concrete |
| 31. | ASTM D 2240 | Test Method for Rubber Property -- Durometer Hardness |
| 32. | PCI MNL-116 | Manual for Quality Control for Plants and Production of Precast Concrete |
| 33. | PCI MNL-117 | Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products |
| 34. | PCI MNL-120 | Design Handbook - Precast and Prestressed Concrete, 3rd Edition |
| 35. | PCI MNL-122 | Architectural Precast Concrete, 2nd Edition |

B. Industry Standards:

1. Reference Specifications and Standards: CONTRACTOR shall comply with the recommendations of the Precast Concrete Institute (PCI), unless otherwise indicated in this Section.
2. Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

1.5 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. Shop Drawings:
 - a. Shop drawings shall show details in accordance with ACI 315 and ACI 318 including installation details and design computations.
 - b. Shop drawings, including design computations, shall be stamped and signed by a structural engineer registered in the State of California.
 - c. Shop drawings shall indicate precast unit identification marks, location of units in the WORK, elevations, fabrication details, welding details, reinforcement, connections, pickup points, boxouts, inserts, dimensions, interface with adjacent members, and special handling instructions in sufficient detail to cover manufacture, handling, and erection. Shop drawings shall include erection drawings.
 - d. Shop drawings shall be divided into complete separate submittals for each structure. Each complete submittal shall consist of a panel schedule and shop drawings, as follows:

Panel schedule shall show all exterior elevations of the building, including all precast concrete enclosure faces exposed to view, in its associated shop drawing submittal. Elevations at a minimum scale of 1/8" = 1'0" shall be drawn, identifying the type and location of each panel by a number which corresponds to the panel number appearing on an associated shop drawing; this same number shall be permanently marked on the back of each panel as they are fabricated.

Shop Drawings: Showing horizontal and vertical sections, openings, inserts, anchorage devices, and other requirements as indicated above for each different type of panel to be incorporated into the portion of the project covered by the submittal.

2. Surface Sealer Manufacturer's Guarantee: The manufacturer shall guarantee that the sealer will not alter or yellow to original concrete color and that it is compatible with the joint sealants to be used.
3. Mix Proportions: Prior to commencing operations, including fabrications of the precast for any mock-up, a statement shall be submitted giving the nominal maximum aggregate size and proportions of all ingredients that will be used in the manufacture of concrete. The statement shall include test results including compressive strength from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made in materials used in the concrete mix without approval and additional tests to verify that the concrete properties are satisfactory. A copy shall be submitted of concrete mix with each set of samples.
4. Small Samples:
 - a. Two [36-inch by 36-inch, minimum] samples of each precast concrete unit finish shall be submitted. Each sample shall show matrix color, surface color, surface texture, and panel back finish.
 - b. The face of each sample shall contain one form joint and at least two areas of approved size and shape which have been chipped out and then patched and repaired; the color, texture and appearance of patched areas and form joint shall match that of adjacent surface.
 - c. Samples will be inspected for uniformity of color and texture throughout the panel and acceptability of patching and joint treatment. The exposed face of samples shall be tested for efflorescence in accordance with ASTM C 67; rating shall not be more than "slightly effloresced."
 - d. If the CONSTRUCTION MANAGER determines that a sample, or samples, are unacceptable, the CONTRACTOR shall fabricate and resubmit additional samples at no additional cost to the OWNER.
 - e. When approved, one sample [of each unit finish] will be kept at the CONSTRUCTION MANAGER's field office and the other shall be picked up by the CONTRACTOR and returned to the manufacturing plant. These sample panels will be used as a comparison to judge acceptability of the full-size panel samples and, where necessary, the production precast units.
5. Full-Size Panel Sample[s] at Manufacturing Plant:
 - a. After the small samples and shop drawings have been approved, and prior to fabricating panels for the project, a full-size panel of specified color and

finish [for each type of unit] shall be produced and erected at the manufacturing plant for inspection and approval by the CONSTRUCTION MANAGER.

- b. The full-size panels shall be fabricated utilizing tools, forms, materials and techniques proposed and the dimensions, profile cross section, color and texture required for the project. Panels will be inspected for color and texture to match the approved small samples, uniformity of color and texture throughout the panel, accuracy and sharpness of shape, acceptability of patched and repaired areas, and form joint treatment.
 - c. If the CONSTRUCTION MANAGER determines that a full-size sample is unacceptable, the CONTRACTOR shall fabricate additional revised panel(s) at no additional cost to the OWNER. When approved, panels shall be preserved, remain at the plant, and become the job standard against which all panels will be compared as they come off the production line.
6. Full-Size Panel Samples at Project Site: From the first loads of acceptable panels for the project, the CONSTRUCTION MANAGER will select one panel of each type which is scheduled to be erected in a prominent location. If the CONSTRUCTION MANAGER chooses, panels may be selected from a later load. The selected full-size panel(s), together with the small [36-inch by 36-inch, minimum] panel kept at the CONSTRUCTION MANAGER's field office, will become the jobsite standard against which all panels will be compared. Accepted full-size panels may be incorporated into the finished WORK.
7. Sample Construction:
 - a. A typical precast concrete combination sectioned wall and related perimeter window assembly shall be constructed and furnished by the CONTRACTOR. This sample construction, after approval, shall serve for comparison as a sample of construction requirements for the rest of the building. Accepted full-size sample may be incorporated into the finished WORK.
 - b. The precast concrete units shall structurally support the window assemblies and include anchorage inserts for windows as indicated. Use of drilled-in anchorage inserts for window supports and anchorage of other items is prohibited. Sample construction shall be sealed and finished as required for a completed wall.
 - c. The sample construction shall demonstrate precast concrete units and window framing, sealants, anchorage, and other elements of construction. The sample construction will be inspected and judged for compliance with requirements and visual appearance, uniformity of color and texture, acceptability of patching and repair, and conformance to required tolerances. If the sample does not provide an acceptable window assembly or meet visual appearance or tolerance requirements, the CONTRACTOR shall modify, repair, or reconstruct the sample at no additional cost.
8. It shall be the CONTRACTOR's responsibility to assure that all precast architectural concrete conforms to quality and appearance requirements. The only appearance criterion is that all precast architectural finishes provided for this project conform in appearance, when viewed from a distance of 20 feet, to the design, color, and texture as represented by the samples except that closeup inspection shall not exhibit any evidence of "bugholes" on exposed surfaces exceeding 1/8-inch and in quantity not more than 2 average per square foot.

9. Certification: A statement shall be submitted giving the qualifications of the precast concrete fabricator, and evidence that the manufacturer is PCI certified.

1.6 OWNER'S MANUAL

- A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:
 1. Certificates of Compliance: Certificates of compliance shall be submitted attesting that materials and products meet the indicated requirements.
 2. Test Reports: Test reports, by an independent testing laboratory, for compressive strength of concrete and properties of cement, shall be submitted.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Precast members shall be lifted and supported from design incorporated support points based on design calculations and provided with strong backs and other devices as required. Lifting equipment shall be capable of handling units during manufacture, storage, transportation, erection, and fastening.
- B. Blocking and supports, lateral restraints and protective materials during transport and storage shall be clean, nonstaining, causing no harm to exposed surfaces. Lateral restraints shall be provided to prevent undesirable horizontal movement. Edges and exposed faces of members shall be protected to prevent straining, chipping, or spalling of concrete.
- C. Precast units shall be stored off the ground in a manner to prevent warpage and shall be protected from weather, marring, and overload.
- D. Stainless steel hardware shall be protected in wood crates during transportation, handling, and storage.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Design shall be performed under direct supervision of a professional structural engineer experienced in design of precast concrete units and registered in the State of California. Design shall conform to requirements of PCI MNL-120, PCI MNL-122, and to ACI 318.
 1. Precast fabricator and erectors shall be qualified in accordance with PCI MNL-117 and MNL-116.
 2. Welding shall be in accordance with AWS D1.1, AWS D12.1, AWS B2.1, and AWS A5.4.

2.2 DESIGN REQUIREMENTS

- A. **General:** The precast concrete panel and connection designs represent minimum requirements. The CONTRACTOR shall have the fabricator verify the panel and connection designs for all handling, erection, and service conditions, and shall provide any additional materials necessary to meet the design conditions.
- B. **Standards and Loads:** The precast panel and connection design and construction shall conform to all applicable codes including the latest City of San Diego Building

Code, Building Code Requirements for Reinforced Concrete ACI 318 and AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. The precast or prefabricated, nonbearing, nonshear wall panels and connections which are attached to or enclose the exterior, shall be capable of resisting handling and erection loads, and in addition to dead loads, the following forces:

1. Wind pressure and loading combinations in accordance with the UBC Exposure [D] [], 70 mph, $I = [1.15] [1.0]$
2. Seismic loading in accordance with UBC Seismic Zone 4:

$$F_p = ZIC_pW_p$$

C_p shall be as appropriate for the application. Connections shall have the deformation, ductility and strength requirements specified in the UBC. Bolts, inserts welds and dowels shall be desired for 4 times the force, F_p , calculated from the formula, above.

3. The design shall be based on a differential temperature of 50 degrees F between interior and exterior faces of the units and an 80 degrees (plus or minus 40 degrees from erected temperature) average panel temperature differential.
4. The design shall account for stresses due to restrained volume changes caused by shrinkage and temperature differentials.

C. **Connections:** Prior to submitting shop drawings, the CONTRACTOR shall verify the precast connection designs against the indicated design and the following design criteria and provide any additional materials necessary to meet the design conditions.

1. The panel joints shall be designed to accommodate an in-plane movement between stories of 0.005 times the story height in inches but not less than 3/4-inch.
2. Panel connections shall accommodate building movement and permit panels to move freely so as not to resist in plane deformation of the main frame structural system. Adjustment shall be provided to accommodate misalignment of structure without permanent distortion, damage to components, racking of joint connection, breakage of seals, or moisture penetration.

D. **Concrete Mix:** The concrete mix shall be designed by the manufacturer and approved by the CONSTRUCTION MANAGER, using the materials and quantities specified to meet all of the requirements of this specification.

1. Proportioning of Concrete Mixes: Mixes shall be proportioned by weight except water and admixtures may be batched by volume if desired. Trial mixes and testing to meet requirements of the strengths of concrete specified are the CONTRACTOR's responsibility. Design mix shall contain similar materials as those proposed for use in the WORK.
2. Admixtures: Concrete shall contain an air entraining admixture in proportion so as to provide 4 percent plus or minus 1 percent total air in the concrete as determined by ASTM C 173 or C 231. Set retarding admixtures may be used provided cement content is not reduced. Water reducing admixtures may be used provided they are used in the mix design studies. High-range water reducers (superplasticizers) shall be used only where specifically called for in this Section, otherwise superplasticizers shall not be used without written approval

from the CONSTRUCTION MANAGER. No admixture may contain chlorides, bromides, or fluorides.

3. Water: Clean, potable water. The CONTRACTOR shall conduct tests to assure that no more than 200 parts per million of combined chlorides, bromides, and fluorides are present. In other respects, the water shall be of potable water quality.
- E. **Formwork:** Formwork shall be designed to withstand high-frequency vibration and to ensure finished units.
- F. **Pickup Points and Boxouts:** Pickup points, boxouts, and inserts on panel faces and exposed surfaces are prohibited except as approved on the shop drawings.

2.3 CONCRETE MATERIALS

- A. Cement shall comply with ASTM C 150, Type II, "low alkali," white color. The "low alkali" requirement may be waived if not reactive as defined in Appendix to ASTM C 33.
- B. Aggregates shall comply with ASTM C 33. Coarse aggregate shall be 1/2-inch maximum size; ratio of fine aggregate to total aggregate volume shall be 0.35 minimum and 0.55 maximum. Water absorption in coarse aggregate shall comply with ASTM C 127, and in fine aggregate, shall comply with ASTM C 128.
- C. Reinforcing steel shall comply with ASTM A 615, Grade 60, deformed epoxy coated in accordance with ASTM A 775.
- D. Welded wire fabric shall comply with the following:
 1. Plain, ASTM A 185, epoxy coated.
 2. Deformed steel, ASTM A 497, epoxy coated.
 3. Fabricated steel bar or rod mats, ASTM A 184, epoxy coated.
- E. Tie wire shall comply with ASTM A 580, Type 316L, cold finished annealed.
- F. Air entrainment admixture shall comply with ASTM C 260.
- G. Water reducing or retarding admixtures shall comply with ASTM C 494, Type C, D, or F/G, with no chloride, bromide, and fluoride ingredients.
- H. Silica fume slurry admixture shall be 45 to 50 percent silica fume, water, and superplasticizer as dispersant. Silica fume shall be 85 percent amorphous silicon dioxide in accordance with ASTM C 311; loss on ignition shall not exceed 6 percent and moisture shall not exceed 3 percent in accordance with ASTM C 311. Surface area shall be not less than 10,000 square meters per kilogram at bed porosity of 0.50 in accordance with ASTM C 204.

Water shall be reduced in concrete mix in concrete by 5.6 to 9.5 lbs for each gallon of slurry added to mix, as recommended by slurry manufacturer used.

Mixing procedures shall be as recommended by silica fume slurry manufacturer.

- I. Pigment shall be pure mineral type, color-resistant to alkalis and shall be nonfading. Color shall be as required to produce finished concrete of matching color and appearance of the 72-inch by 72-inch sample at the CONSTRUCTION MANAGER's field office.

2.4 CONNECTION AND SUPPORT DEVICES

- A. Welding of the reinforcing steel, metal inserts and connections shall be in accordance with AWS D12.1. Welding of inserts and splices shall minimize the distortional effect of welding heat.
- B. Connecting and support devices shall be of stainless steel complying with ASTM A 666, Type 316L.
- C. Bolts shall comply with ASTM A 193, Grade B8M (Type 316).
- D. Nuts and Washers shall comply with ASTM A 194, Grade 8M (Type 316).
- E. Weld filler metal for stainless steel shall be as follows:
 - 1. Stainless steel to stainless steel; AWS A5.4, Grade 316L filler metal.
 - 2. Stainless steel to carbon steel, AWS A5.4, Grade 309 filler metal, 3/32-inch diameter.
- F. Primer shall be zinc-dust, zinc oxide primer in a phenolic resin spar varnish vehicle complying with Federal Specification TT-P-641 Type III (for galvanized surfaces).
- G. Drill into or through concrete sections by rotary type drilling to accommodate connection devices or hangers when the sections are less than 2 inches thick.
- H. Where grout or concrete is used to embed connection devices between elements or to fill allowable casting tolerances, follow the requirements of ACI 318.

2.5 ACCESSORIES

- A. Plates, angles, anchors, and studs shall comply with ASTM A 666, Type 316L stainless steel.
- B. Austenitic steel castings for embedments and anchorage assemblies shall comply with ASTM A 351, Type CF3M. Bolts, nuts, and washers shall be of Type 316 stainless steel.
- C. Reglets shall be of plastic, shaped and flanged to remain in place once cast and tape closed to prevent concrete intrusion.
- D. Bearing pads shall be of neoprene, molded to size or cut from molded sheet, 70-80 Type A durometer as per ASTM D 2240.
- E. Sealant shall be as specified in Section 07920.

2.6 FORMS

- A. Forms shall be manufacturer's standard forms with smooth, hard, dense, and rigid casting surface; without bow and warpage, oil canning, or other imperfections.
- B. Form release agent shall be manufacturer's standard release agent, nonstaining, nonpetroleum based and shall be compatible with concrete surface sealer.
- C. Surface sealer shall be clear, flat, penetrating, nonyellowing, nonclouding solution and shall be a high concentration of organosilane in an aqueous alcoholic vehicle which is designed to provide water repellent concrete surfaces from which graffiti can be easily removed. Oil-type silicones, paraffins, waxes, vinyls, modified urethanes, or acrylics

shall not be used. Sealant shall be tested by manufacturer and proved compatible with surface sealer.

2.7 CONCRETE MIX

- A. Silica fume concrete shall have a minimum 5,000 psi, 28-day compressive strength. Aggregate shall be 1/2-inch maximum size; water, 305 lbs per cu yd; cement, 763 lbs per cu yd; water/cement ratio 0.40 max; slump range, 3 inches to 5 inches with silica fume slurry; air entrainment, 4 percent plus or minus 1 percent; 7.5 percent dry silica fume by weight of cement, provided through indicated silica fume slurry. Superplasticizer shall be added to achieve the desired working slump for precast concrete as may be required by silica fume slurry manufacturer. Colorant shall be added as required to achieve color matching the sample in the CONSTRUCTION MANAGER field office.

2.8 FABRICATION

- A. **General:** Precast concrete units shall be fabricated in accordance with ACI 318, PCI MNL-116, and PCI MNL-117. Plant records and quality control program shall be maintained during production of precast units. Records and access to plant shall be available to the CONSTRUCTION MANAGER upon request.

Rigid molds shall be used, constructed to maintain precast unit uniform in shape, size, and finish, free from castings and dents, gouges, oil canning, or other irregularities that will adversely affect appearance or strength of units. Consistent quality shall be maintained during manufacture.

Equipment for handling epoxy-coated reinforcing bars shall have protected contact areas. Bundles of coated bars shall be lifted at multiple pickup points to prevent bar-to-bar abrasion from sags in the bundles. Coated bars or bundles of coated bars shall not be dropped or dragged. Coated bars shall be stored on protective cribbing. The maximum amount of damage shall not exceed 2 percent of the surface area of each bar.

Reinforcing steel, anchors, inserts, plates, angles, and other cast-in-place items shall be embedded as indicated on shop drawings. Reinforcement shall be fabricated and placed in conformance with ACI 318. No tack welding of reinforcement shall be done. Welding when allowed shall conform to AWS D1.4 requirements. No carbon steel chairs, spacers, nails or tie wire shall be used in positioning reinforcing and embedments.

Adequate reinforcing steel shall be provided to control cracking. Maximum permissible crack width shall be as follows:

Surfaces exposed to weather:	0.005 inch.
Surfaces exposed to view but not weather:	0.01 inch

Connecting devices, plates, angles, items to be fitted to steel framing members, inserts, bolts, and accessories shall be fabricated to permit initial placement and final attachment.

Anchors, inserts, lifting devices, and other accessories shall be placed and embedded in accordance with approved shop drawings, accurately positioned in their designed location and anchored to prevent dislocation during panel construction. Flashing reglets shall be placed and embedded continuous and straight, with lifting devices to permit removal after erection.

Precast units shall be removed from formwork using procedures conforming to PCI MNL-117. Minor patching in plant is acceptable, providing structural adequacy and appearance of units are not impaired. Each precast unit shall be identified with date of production and a code corresponding to erection drawings, in a location not visible after fastening.

Repair of damaged epoxy coating, when required, shall be made with patching material conforming to ASTM A 775. Repair shall be in accordance with the material manufacturer's recommendations.

B. Curing:

1. Precast elements shall be cured to prevent shrinkage, warpage, or loss of ultimate strength.
2. All precast concrete elements shall be kept at a minimum of 60 degrees F after casting and under moist condition for at least the time of the setting of the cement.
3. All precast concrete elements shall be steam cured at maximum temperature not exceeding 150 degrees F. Steam shall not be applied until such time as the elements have reached stripping strength and are removed from the molds or forms. Continue until concrete reaches its indicated strength.

C. Fabrication and Tooling of Stainless Steel Connections and Embedments: All tools used during fabrication shall be made of stainless steel. Use of carbon steel tools is prohibited.

Welding of stainless steel shall conform to AWS A5.4, AWS B2.1 and AWS D1.1, using tungsten inert gas procedures and 316L filler metal for stainless steel to stainless steel and 309 filler metal for stainless steel to carbon steel. Surfaces shall be sanded smooth (do not grind), and oxidized discoloration removed. Threaded parts of stainless steel bolts shall be lubricated with graphite suspended in alcohol every time that nut is run on or off the threads. No other lubricant is acceptable.

Erection slings, cables, blocking, hardware and restraints shall be nonmetallic or stainless steel. Cribbing or crating shall be wood.

2.9 FINISH OF PRECAST UNITS

- A. **Backs and Sides:** Finish of backs and sides shall be smooth, dense, uniform surface free from blemishes. Defects in backs and sides and unexposed edges shall be repaired.
- B. **Faces:** Appearance, color, and texture finish of all panels shall match appearance, color and texture of the approved sample panels. Panels that do not match will be rejected. Repairs will be acceptable only if structural adequacy and appearance of product are not impaired and the repair and surrounding area match the approved sample panels.

Mechanical finishing of panels at precast plant shall be at essentially the same age or strength of concrete to assure finished appearance is uniform from panel to panel.

Seal finish surfaces of precast units to be exposed in completed WORK as follows: apply a uniform coat of surface sealer in accordance with manufacturer's written instructions. Apply sealer by method and in quantity required to provide coverage specified by sealer manufacturer. Forty-eight hours after application of sealer, apply

water to face of each panel in sufficient quantity to determine if full sealer coverage was achieved. Panels not fully sealed shall be resealed and retested. A second coat shall be applied at the jobsite after erection and cleanup in accordance with the manufacturer's instructions.

2.10 MANUFACTURERS

A. Products shall be of the following manufacture and type (or equal):

1. Silica Fume Slurry Admixture:

Sika "Sikacrete 950"

W.R. Grace "Force 10,000"

PART 3 -- EXECUTION

3.1 HANDLING AND ERECTION

A. Before erecting, all relevant project site conditions shall be checked insofar as they affect the future installation of precast elements.

1. Uninterrupted access to the project site from street to storage (if required) shall be arranged and from storage to erection points for all transportation and erection equipment required by the erector.

2. Permanent bench marks shall be accurately established and maintained, building lines and levels at convenient locations in order to ensure expeditious and accurate erection of all precast elements. Maintain proper tolerances in this WORK for the attached of the work of other crafts.

B. The design, fabrication and employment of all strongbacks, shoring, and erection bracing is part of the WORK of this Section.

C. Elements shall be erected in accordance with the referenced standards, drawings, Specifications, and CONSTRUCTION MANAGER approved submittals, using competent craftspersons under the continuous supervision of the fabricator. Elements shall be accurately set in the positions assigned to them on the reviewed installation or erection drawings and securely anchored in final positions. All joints shall be sealed in strict conformity with detail drawings.

1. Erection procedures shall be determined by the fabricator in conjunction with the erector.

2. All chipped, cracked, discolored, blemished, damaged, or otherwise defective precast elements, not feasible to repair, shall be replaced until acceptable to the CONSTRUCTION MANAGER, without additional cost to the OWNER.

3. No elements shall be shipped to the project site unless they are at least 14 days old and unless they have reached 80 percent of their indicated 28 day strength.

D. **Bond Breaker and Curing Compound:** Bond breaker and curing compound shall be applied in strict accordance with manufacturer's printed instructions. Under no circumstances shall the compound be allowed to contact reinforcing.

E. The vertical units shall be set dry, without grout, attaining joint separation with lead or plastic shims and spacers.

- F. Pickup points, boxouts, inserts and bearing surfaces shown shall be grouted with non-shrink grout in accordance with Section 03315. Concrete surfaces of adjacent areas shall in the same plane and shall be matching in color and texture.
- G. **Tolerances:** Tolerances shall be in accordance with requirements of PCI MNL-117 and as follows:
 - 1. Variation from Plane of Location: 1/4-inch in 10 feet and 3/8-inch in 100 feet maximum, compensating not cumulative.
 - 2. Offset from True Alignment between Two Connecting Members: 1/4-inch maximum.
 - 3. Out of Square: 1/8-inch in 10 feet maximum, noncumulative.
 - 4. Variation in Dimensions Indicated in Shop Drawings: Plus or minus 1/8-inch.
 - 5. Misalignment of Anchors, Inserts, Openings: 1/8-inch, maximum.
 - 6. Bowing or Warpage of Units: 1/700 of panel dimension.
 - 7. Exposed Joint Dimension: 3/4-inch plus or minus 1/8-inch.
 - 8. Location of Reglets: 1/4-inch from true position.
- H. **Joint Sealing:** Joint sealing shall comply with Section 07920.

3.2 REPAIRS

- A. After WORK is completed, damaged surfaces and cracks shall be properly repaired until acceptable to the CONSTRUCTION MANAGER. Where repairs are not acceptable, the WORK shall be removed and conforming WORK provided at no additional cost to the OWNER.

3.3 CLEANING

- A. Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of precast units shall be cleaned using a cleaning detergent recommended by the sealer manufacturer and water applied with a soft bristle brush, and thoroughly rinsed using clean water or other approved procedures.
- B. Units shall be cleaned when temperature and humidity conditions are such that surfaces dry rapidly (e.g., 70 degrees F and rising, 50 percent relative humidity or less).
- C. Discolorations which cannot be removed by these procedures shall be considered defective work, and repaired or replaced as directed by CONSTRUCTION MANAGER.

3.4 CARE AND PROTECTION

- A. Adjacent surfaces shall be protected from damage during sealing and cleaning operations and against damage, disfiguration or discoloration from subsequent operations. Noncombustible shielding shall be used during welding operations.

** END OF SECTION **