

## 10.2 GUIDE SPECIFICATION FOR ARCHITECTURAL PRECAST CONCRETE

This Guide Specification is intended to be used as a basis for the development of an office master specification or in the preparation of specifications for a particular project. In either case, this Guide Specification must be edited to fit the conditions of use.

Particular attention should be given to the deletion of inapplicable provisions. Necessary items related to a particular project should be included. Also, appropriate requirements should be added where blank spaces have been provided.

The Guide Specifications are on the left. *Notes to Specifiers are on the right.*

### GUIDE SPECIFICATIONS

### NOTES TO SPECIFIERS

#### 1. GENERAL

##### 1.01 Description

###### A. Work included:

*1.01A Local standard practice may indicate that responsibility for erection may not be included.*

1. The specifications establish general criteria for materials, production, erection and evaluation of precast concrete as required for subsequent related sections of these specifications. The work to be performed shall include all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete units shown on the contract drawings and schedules.

###### B. Related work specified elsewhere:

1. Concrete reinforcement: Section \_\_\_\_\_.

*1.01B.1 Architectural precast reinforcing steel requirements are different from cast-in-place reinforcement and should be specified in this section.*

2. Cast-in-place concrete: Section \_\_\_\_\_.

*1.01B.2 For placement of anchorage devices in cast-in-place concrete for precast concrete panels.*

3. Precast, prestressed concrete:  
Section \_\_\_\_\_.

*1.01B.3 For precast floor and roof slabs, beams, columns and other structural elements. Some items, such as prestressed wall panels on industrial buildings, could be included in either specification, depending on the desired finish and tolerance expectation.*

4. Structural steel framing: Section \_\_\_\_\_.

*1.01B.4 For steel supporting structure, attachment of anchorage devices on steel for precast concrete panels, and sometimes loose anchors.*

5. Water repellent coatings: Section \_\_\_\_\_.

*1.01.B.5 For exposed face of panels. Delete when specified in this section.*

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## NOTES TO SPECIFIERS

6. Insulation: Section \_\_\_\_.
7. Flashing and sheet metal: Section \_\_\_\_.
8. Sealants and caulking: Section \_\_\_\_.
9. Painting: Section \_\_\_\_.
10. Glass and glazing: Section \_\_\_\_.
11. Glazing accessories: Section \_\_\_\_.
- C. Work installed but finished by others:
1. Counterflashing receivers or reglets:  
Section \_\_\_\_.
2. Inserts or attachments for \_\_\_\_\_ :  
Section \_\_\_\_.
- D. Testing agency provided by owner.

*1.01.B.6 For insulation that is job-applied to precast concrete panels. Insulation cast in precast concrete panels during manufacture should be specified in this section.*

*1.01.B.7 For counterflashing inserts and receivers, unless included in this section.*

*1.01.B.8 For panel joint caulking and sealing.*

*1.01.B.9 For field touch-up painting. Delete when specified in this section.*

*1.01.B.10 For glazing of precast concrete panels in plant. Delete when specified in this section.*

*1.01.B.11 For reglets used with structural glazing gaskets. Delete when specified in this section.*

*1.01.C.1 Delete when furnished by precast concrete manufacturer. Add additional items as may be required for the particular project.*

*1.01.C.2 May include inserts/attachments for window or door frames, window washing equipment, etc.*

*1.01.D Delete when testing agency is provided by precast concrete manufacturer or general contractor. Coordinate with appropriate section of Division 1, General Conditions.*

### 1.02 Quality Assurance

- A. Manufacturer qualifications:  
The precast concrete manufacturing plan shall be certified by the Precast/Prestressed Concrete Institute Plan Certification Program. Manufacturer shall be certified at the time of bidding. Certification shall be in the following product groups and categories: \_\_\_\_\_.
- B. Erector qualifications:  
Regularly engaged for at least \_\_\_\_\_ years in erection of architectural precast concrete units similar to those required on this project.

*1.02.A Groups and categories: (A1), (AT), (G). See Sect. 9.5 for definitions. It is recommended that the architect approve individual precast concrete manufacturers who meet the Quality Assurance Specification at least ten days prior to the bid date, or identify approved manufacturers in the specification. It is not appropriate to specify structural products with architectural finishes in this section.*

*1.02.B Usually 2 to 5 years.*

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- C. Welder qualifications:  
In accordance with AWS D1.1.
- D. Testing:  
  
In general compliance with testing provisions in MNL-117, *Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products*.
- E. Testing agency:
1. Not less than \_\_\_\_\_ years experience in performing concrete tests of type specified in this section.
  2. Capable of performing testing in accordance with ASTM E 329.
  3. Inspected by Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology.
- F. Requirements of regulatory agencies:  
  
Manufacture and installation of architectural precast concrete to meet requirements of \_\_\_\_\_.
- G. Allowable tolerances:
1. Manufacture and install wall panels so that each panel after erection complies with the dimensional tolerances listed in MNL-117.
- H. Job mockup:
1. After standard samples are accepted for color and texture, submit full-scale unit meeting design requirements.
  2. Mockup to be standard of quality for architectural precast concrete work, when accepted by architect/engineer.
  3. Incorporate mockup into work in a location reviewed by architect/engineer after keeping mockup in plant \_\_\_\_\_ for checking purpose.

## NOTES TO SPECIFIERS

- 1.02.C Certified within the past year. Delete when welding is not required.*
- 1.02.E Delete when provided by owner.*
- 1.02.E.1 Usually 2 to 5 years.*
- 1.02.F Local building code or other governing code relating to precast concrete. For projects in Canada, standards from the Canadian Standards Association should be listed in addition to or in place of the U.S. standards.*
- 1.02.G Dimensional tolerances apply to both manufacturing and after manufacturing. The tolerances listed in PCI MNL-117 are also listed in Chapter 8 of this Handbook. Most manufacturers can meet closer tolerances, if required, but closer tolerances normally increase costs. The normal tolerance of the support system should also be recognized.*
- 1.02.H.1 Full-scale samples or inspection of the first production unit are normally required, especially when a new design concept or new manufacturing process or other unusual circumstance indicates that proper evaluation cannot otherwise be made. It is difficult to assess appearance from small samples.*
- 1.02.H.2 Use to determine range of acceptability with respect to color and texture variations, surface defects and overall appearance. Mockup should also serve as testing areas for remedial work. It should also be stated in the contract documents who the accepting authority will be.*
- 1.02.H.3 Delete when mockup is not to be included in work. State how long unit should be kept. Mockup is normally incorporated in the building, at least for production units.*

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## NOTES TO SPECIFIERS

### I. Source quality control:

1. Quality control and inspection procedures to comply with applicable sections of MNL-117.
  
2. Water absorption test on unit shall be conducted in accordance with MNL-117.

*1.02.1.2 Water absorption test is an early indication of weather staining (rather than durability). Verify the water absorption of the proposed face mix. For average exposures and based upon normal weight concrete (150 lbs per cubic ft), water absorption should not exceed 5% to 6% by weight. In order to establish comparable absorption figures for all materials, the current trend is to specify absorption percentages by volume. The stated limits for absorption would, in volumetric terms, correspond to 12% to 14% for average exposures and 8% to 10% for special conditions.*

### 1.03 Submittals

#### A. Samples:

1. Submit samples representative of finished exposed face showing typical range of color and texture prior to commencement of production.
2. Sample size: Approximately 12 in. x 12 in. and of appropriate thickness, representative of the proposed finished product.

*1.03.A Number of samples and submittal procedures should be specified in Division 1. All approved samples should be initialed by the architect. Pre-bid samples should be submitted a minimum of 10 days prior to bid date.*

*1.03.A.1 If the back face of a precast concrete unit is to be exposed, samples of the workmanship, color, and texture of the backing should be shown as well as the facing.*

#### B. Shop drawings:

1. Erection drawings:
  - a. Member piece marks and completely dimensioned size and shape of each member.
  - b. Plans and/or elevations locating and defining all products furnished by manufacturer.
  - c. Sections and details showing connections, cast-in items and their relation to the structure.
  - d. Relationship to adjacent material.
  - e. Joints and openings between members and between members and structures.

*1.03.B State the number of copies required for approval or whether reproduces are required. Current practice usually calls for two prints and one reproducible of shop drawings to be submitted for approval. General contractor should expedite submittal with architect/engineer to conform with allotted shop drawing approval time shown on the precast concrete supplier's order acknowledgment. When erection drawings contain all information sufficient for design approval, production drawings, except for shape drawings, need not be submitted for approval, except in special cases. However, record copies are frequently requested. Guidelines for the preparation of drawings are given in the PCI Drafting Handbook—Precast and Prestressed Concrete, Second Edition, MNL-119-90.*

*1.03.B.1.d Details, dimensional tolerances and related information of other trades affecting precast concrete work should be furnished to precast concrete manufacturer.*

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- f. Description of all loose, cast-in and field hardware.
- g. Location, dimensional tolerances, and details of anchorage devices that are embedded in or attached to structure or other construction.
- h. Erection sequences, when required to satisfy stability, and handling requirements.
- i. All dead, live and other applicable loads used in the design.

### 2. Production drawings:

- a. Member shapes (elevations and sections) and dimensions.
- b. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.
- c. Handling devices.
- d. Finishes.
- e. Joint and connection details.
- f. Methods for storage and transportation.

### 3. Shape drawings:

For members with complex configurations, complete dimensions and details that also define mold shape.

### C. Design calculations:

Submit, on request, structural design calculations performed by a registered engineer experienced in the design of architectural precast concrete.

### D. Design modifications:

- 1. Submit design modifications necessary to meet performance requirements and field coordination.
- 2. Variations in details or materials shall not adversely affect the appearance, durability or strength of units.
- 3. Maintain general design concept without altering size of members, profiles and alignment.

## NOTES TO SPECIFIERS

*1.03.B.1.g Drawing normally prepared by precast concrete manufacturer and provided to general contractor for work by other trades.*

*1.03.B.1.h If the sequence of erection is critical to the structural stability of the structure, or for access to connections at certain locations, it should be noted on the contract plans and specified.*

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- E. Test reports:  
Submit, on request, reports on materials, compressive strength tests on concrete and water absorption tests on units.

### 1.04 Product Delivery, Storage, and Handling

- A. Delivery and handling:
1. Deliver all architectural precast concrete units to project site in such quantities and at such times to ensure continuity of erection.
  2. Handle and transport units in a position consistent with their shape and design in order to avoid stresses which would cause cracking or damage.
  3. Lift or support units only at the points shown on the shop drawings.
  4. Place non-staining resilient spacers of even thickness between each unit.
  5. Support units during shipment of non-staining shock-absorbing material.
  6. Do not place units directly on ground.
- B. Storage at jobsite:
1. Store and protect units to prevent contact with soil, staining, and physical damage.
  2. Store units, unless otherwise specified, with non-staining resilient supports located in same positions as when transported.
  3. Store units on firm, level, and smooth surfaces.
  4. Place stored units so that identification marks are discernible, and so that product can be inspected.

## 2. PRODUCTS

### 2.01 Materials

- A. Concrete:
1. Portland cement:
    - a. ASTM C 150, type \_\_\_\_\_, \_\_\_\_\_ color.

## NOTES TO SPECIFIERS

*1.03.E The number and/or frequency of each type of test should be clearly stated in the specifications by listing the required testing or by reference to applicable standards, such as PCI MNL-117. Schedule of required tests, number of copies of test reports, and how distributed are included in Testing Laboratory Services, Section \_\_\_\_\_.*

*1.04.A Erector should coordinate arrival of precast concrete units and provide for possible storage and for erection in a safe manner within the agreed schedule and with due consideration for other trades. Handling procedures, including type and location of fastenings, should normally be left to the precaster, but the fastening devices should be located and identified on shop drawings.*

*1.04.B The ideal sequence of precast concrete erection is the unloading of units directly to their proper location on the structure without storing on the jobsite. If on-site storage is an absolute necessity to enable the erector to operate at the speed required to meet the established schedule, leaving the precast concrete units on the trailer eliminates extra handling or possible damage caused by improper on-site storage techniques.*

*2.01.A.1.a Type: [I(General use)], [III(High early strength)]. Color: (gray), (white), (buff). Gray is generally used for non-exposed backup concrete. Finish requirements will determine color selected for face mix.*

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- b. For exposed surfaces use same brand, type, and source of supply throughout.
2. Cementitious materials:
  - a. Fly ash or natural pozzolans: ASTM C 618.
  - b. Ground granulated blast furnace slag: ASTM C 989.
  - c. Silica fume: ASTM C 1240
3. Air entraining agent: ASTM C 260.
4. Water reducing, retarding, accelerating, high range water reducing admixtures: ASTM C 494 or C 1017.
5. Coloring agent:
  - a. Synthetic mineral oxide.
  - b. Harmless to concrete set and strength.
  - c. Stable at high temperature.
  - d. Sunlight- and alkali-fast.
6. Face mix aggregates:
  - a. Provide fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for entire job. They shall be clean, hard, strong, durable, and inert, free of staining or deleterious material.
  - b. ASTM C 33 or C 330.
  - c. Material and color: \_\_\_\_\_.
  - d. Maximum size and gradation: \_\_\_\_\_.

## NOTES TO SPECIFIERS

- 2.01.A.1.b To minimize color variation. Specify source of supply when color shade is important.*
- 2.01.A.2 Selection and use of these cementitious material in the concrete mix should be left to the precast concrete manufacturer subject to approval by the architect/engineer. The use of fly ash and/or silica fume may affect the color of the finished concrete.*
- 2.01.A.3 Delete if air entrainment is not required.*
- 2.01.A.4 Delete if water reducing, retarding, or accelerating admixtures are not required. Calcium chloride, or admixtures containing significant amounts of calcium chloride, should not be allowed. The selection of the particular admixture(s) should be left to the precast concrete manufacturer subject to approval by the architect/engineer.*
- 2.01.A.5 Investigate use of naturally colored fine aggregate in lieu of coloring agent. Delete if coloring agent is not required.*
- 2.01.A.5.b Consider effects upon concrete prior to final selection.*
- 2.01.A.6.a Approve or select the size, color and quality of aggregate to be used. Base choice on visual inspection of concrete sample and on assessment of certified test reports. Use same type and source of supply to minimize color variation. Fine aggregate is not always from same source as coarse aggregate.*
- 2.01.A.6.b Grading requirements are generally waived or modified.*
- 2.01.A.6.c Specify type of stone desired such as crushed marble, quartz, limestone, granite, or locally available gravel as well as color. Some lightweight aggregates, limestones, and marbles may not be acceptable as facing aggregates. Omit where sample is to be matched.*
- 2.01.A.6.d State required sieve analysis. Omit where sample is to be matched.*

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7. Backup concrete aggregates:
    - a. ASTM C 33 or C 330.
  8. Water: Free from deleterious matter that may interfere with the color, setting or strength of the concrete.
- B. Reinforcing steel:
1. Materialals:
    - a. Bars:
      - (1) Deformed steel:  
ASTM A 615, grade 60.
      - (2) Weldable deformed steel:  
ASTM A 706
      - (3) Galvanized reinforcing bars:  
ASTM A 767
      - (4) Epoxy coated reinforcing bars:  
ASTM A 775.
    - b. Welded wire reinforcement:
      - (1) Welded plain steel:  
ASTM A 185
      - (2) Welded deformed steel:  
ASTM A 497
      - (3) Epoxy coated welded wire fabric:  
ASTM A 844.
    - c. Fabricated steel bar or rod mats:  
ASTM A 184
    - d. Prestressing strand:  
ASTM A 416, grade \_\_\_\_\_.

## NOTES TO SPECIFIERS

- 2.01.A.7 Delete when architectural requirements dictate that face mix be used throughout the unit.*
- 2.01.A.8 Potable water is ordinarily acceptable.*
- 2.01.B.1 Grades of reinforcing steel are determined by the structural design of the precast concrete units. Panels are normally designed as crack-free sections or with controlled cracking, thus the benefit of higher grade steel is not utilized.*
- 2.01.B.1.a State uncoated, galvanized or epoxy coated. Use galvanizing or epoxy coating only where corrosive environment or sever exposure conditions justify extra cost. Availability of galvanized or epoxy coated bars should be verified.*
- 2.01.B.1.a(2) Availability should be checked. When not available, establish weldability in accordance with AWS D1.4.*
- 2.01.B.1.a(3) Damage to the coating as a result of bending should be repaired with zinc-rich paint.*
- 2.01.B.1.a(4) Damage to the coating as a result of mishandling or field cutting should be repaired with epoxy paint.*
- 2.01.B.1.b Should be sheets, not rolls. State uncoated, galvanized or epoxy coated. Use galvanizing or epoxy coating only where corrosive environment or exposure conditions justify extra cost.*
- 2.01.B.1.d Occasionally used in long and/or thin panels. Grades 250 or 270.*

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- C. Cast-in anchors:
1. Materials:
    - a. Structural steel: ASTM A 36
    - b. Stainless steel: ASMT A 666, type 304, grade \_\_\_\_\_.
    - c. Carbon steel plate: ASTM A 283, grade \_\_\_\_\_.
    - d. Malleable iron castings: ASTM A 47, grade \_\_\_\_\_.
    - e. Carbon steel castings: ASTM A 27, grade 60-30.
    - f. Bolts: ASTM A 307 or A 325.
    - g. Welded headed studs: ASTM A 108.
    - h. Deformed bar anchors: ASTM A 496 or A 706.
  2. Finish:
    - a. Shop primer: FS TT-P-86, oil base paint, type I, or SSPC-Paint 14, or manufacturer's standard.
    - b. Hot-dipped galvanized: ASTM A 123, electroplated or metalized.
    - c. Cadmium coating: ASTM B 766.
    - d. Zinc rich coating: DOD-P-21035, self curing, one component, sacrificial.
- D. Receivers for flashing: 28 ga. formed \_\_\_\_\_, or polyvinyl chloride extrusions.

*2.01.C Loose attachment hardware usually specified under Miscellaneous Metals.*

*2.01.C.1.a For carbon steel connection assemblies.*

*2.01.C.1.b Stainless steel anchors for use only when resistance to staining merits extra cost. (A), (B).*

*2.01.C.1.c (A), (B), (C), (D).*

*2.01.C.1.d Usually specified by type and manufacturer. Grades 32510 or 35018.*

*2.01.C.1.e For cast steel clamps.*

*2.01.C.1.f For low-carbon steel bolts, nuts and washers.*

*2.01.C.2.a For exposed carbon steel anchors.*

*2.01.C.2.b For exposed carbon steel anchors where corrosive environment justifies the additional cost. Field welding should generally not be permitted on galvanized elements, unless the galvanizing is removed.*

*2.01.C.2.c Particularly appropriate for threaded fasteners.*

*2.01.C.2.d For galvanized repair use high zinc-dust content paint with dry film containing not less than 94% zinc dust by weight and complying with DOD-P-21035A or SSPC paint 20.*

*2.01.D (stainless steel), (copper), (zinc). Coordinate with flashing specification to avoid dissimilar metals. Delete when included in flashing and sheet metal section. Specify whether precaster or others furnish.*

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E. Sandwich panel insulation: \_\_\_\_\_.

F. Grout:

1. Cement grout: Portland cement, sand, and water sufficient for placement and hydration.
2. Non-shrink grout: Premixed, packaged ferrous or non-ferrous aggregate shrink-resistant grout.
3. Epoxy-resin grout: Two-component mineral-filled epoxy-resin: ASTM C 881 or FS MMM-A-001993.

G. Bearing Pads:

1. Chloroprene (Neoprene): Conform to Division II, Sect. 18 of AASHTO Standard Specifications for Highway Bridges.
2. Random oriented fiber reinforced: Shall support a compressive stress of 3000 psi with no cracking, splitting or delaminating in the internal portions of the pad.
3. Duck layer reinforced: Conform to Division II, Sect. 18.10.2 of AASHTO Standard Specifications for Highway Bridges or Military Specification MIL-C-332D.
4. Plastic: Multimonomer plastic strips shall be non-leaching and support construction loads with no visible overall expansion.
5. Tetrafluoroethylene (TFE): Reinforced with glass fibers and applied to stainless or structural steel plates.

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*2.01.E Specify type of insulation such as foamed plastic (polystyrene and polyisocyanurate), glasses (foamed glass and fiberglass), foamed or cellular lightweight concretes, or lightweight mineral aggregate concretes. Thickness of sandwich panel insulation governed by wall U-value requirements.*

*2.01.F.2 Grout permanently exposed to view should be non-oxidizing (non-ferrous).*

*2.01.F.3 Check with local suppliers to determine availability and types of epoxy-resin grouts.*

*2.01.G.1 AASHTO grade pads having a minimum durometer hardness of 50 and utilizing 100% chloroprene as the elastomer. Less expensive commercial grade pads are available, but are not recommended.*

*2.01.G.2 Standard guide specifications are not available for random oriented, fiber reinforced pads. Proof testing of a sample from each group of 200 pads is suggested. Normal service load stresses are 1500 psi, so the 3000 psi test load provides a factor of 2 over service stress. The shape factor for the test specimens should not be less than 2. If adequate test data are provided by the pad supplier, further proof testing may not be required.*

*2.01.G.4 Compression stress in use is not normally over a few hundred psi and proof testing is not considered necessary. No standard guide specifications are available.*

*2.01.G.5 ASTM D 2116 applies only to basic TFE resin molding and extrusion material in powder or pellet form. Physical and mechanical properties must be specified by naming manufacturer or other methods.*

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### 2.02 Concrete Mixes

#### A. Concrete Properties:

1. Water-cementitious materials ratio: maximum 40 lbs. of water to 100 lbs. of cementitious materials.
2. Air entrainment: Amount produced by adding dosage of air entraining agent that will provide 19% +/- 3% of entrained air in standard 1:4 sand mortar as tested according to ASTM C 185; or minimum 3%, maximum 6%.
3. Coloring agent: Not more than 10% of cementitious materials weight.
4. 28-day compressive strength: Minimum of 5000 psi when tested by 6 x 12 or 4 x 8 in. cylinders; or minimum 6250 psi when tested on 4 in. cubes.

#### B. Face mix:

1. Minimum thickness of face mix after consolidation shall be at least on in. or a minimum of 1  $\Omega$  times the maximum size of aggregates used, whichever is larger.
2. Water-cementitious materials and cementitious materials-aggregate ratios of face and backup mixes shall be similar.

#### C. Design mixes to achieve required strengths shall be prepared by independent testing facility or qualified personnel at precast concrete manufacturer's plant.

*2.02.A The backup concrete and the surface finish concrete can be of one mix design, depending upon resultant finish, or the surface finish (face mix) concrete can be separate from the backup concrete. Clearly indicate specific requirements for each face of the product or allow manufacturer's option.*

*2.02.A.1 Keep to a minimum consistent with strength and durability requirements and placement needs.*

*2.02.A.2 Gradation characteristics of most facing mix concrete will not allow use of a given percentage of air. PCI recommends a range of air entraining be stated in preference to specified percentage.*

*2.02.A.3 Amount used should not have any detrimental effects on concrete qualities. Delete if coloring agent is not required.*

*2.02.A.4 Vary strength to match requirements. Strength requirements for facing mixes and backup mixes may differ. Also the strength at time of removal from the molds should be stated if critical to the engineering design of the units. The strength level of the concrete should be considered satisfactory if the average of each set of any three consecutive cylinder strength tests equals or exceeds the specified strength and no individual test falls below the specified value by more than 500 psi.*

*2.02.B Delete if separate face mix is not used.*

*2.02.B.1 Minimum thickness should be sufficient to prevent bleeding through of the backup mix and should be at least equal to specified minimum cover of reinforcement.*

*2.02.B.2 Similar behavior with respect to shrinkage is necessary in order to avoid undue bowing and warping.*

*2.02.C Proportion mixes by either laboratory trial batch or field experience methods using materials to be employed on the project for each type of concrete required. Test will be necessary on all mixes including face, backup, and standard, which may be used in production of units. Water content should remain as constant as possible during manufacture.*

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### 2.03 Fabrication

A. Manufacturing procedures shall be in general compliance with PCI MNL-117.

B. Finishes:

*2.03.B Finishing techniques used in individual plants may vary considerable from one part of the continent to another, and between individual plants. Many plants have developed specific techniques supported by skilled operators or special facilities.*

1. Exposed face to match approved sample or mockup panel.

*2.03.B.1 Preferable to match sample rather than specify method of exposure.*

\*OR\*

1. Smooth finish:

a. As cast using flat, smooth, non-porous molds.

*2.03.B.1.a Difficult to obtain uniform finish.*

\*OR\*

1. Smooth finish:

a. As cast using fluted, sculptured, board finish or textured form liners.

*2.03.B.1.a Many standard shapes of plastic form liners are readily available.*

\*OR\*

1. Textured finish:

a. Achieve finish on face surface of precast concrete units by form liners applied to inside of forms.

b. Distressed finish by breaking off portion of face of each flute.

*2.01.B.1.b Delete if distressed finish is not desired.*

c. Achieve uniformity of cleavage by alternately striking opposites sides of flute.

\*OR\*

1. Exposed aggregate finish:

a. Apply even coat of retardant to face of mold.

b. Remove units from molds after concrete hardens.

c. Expose coarse aggregate by washing and brushing or lightly sandblasting away surface mortar.

d. Expose aggregate to produce a \_\_\_\_\_ exposure.

*2.03.B.1.d (light) (medium) (deep). Finishes obtained vary from light etch to heavy exposure, but must relate to a maximum depth or one-third the average diameter of coarse aggregate but not more than one-half the diameter of smallest sized coarse aggregate.*

\*OR\*

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### 1. Exposed aggregate finish:

- a. Immerse unit in tank of acid solution.  
\*OR\*
- a. Pressure spray with acid and hot water solution.  
\*OR\*
- a. Treat surface of unit with brushes which have been immersed in acid solution.  
\*\*\*\*
- b. Protect hardware, connections and insulation from acid attack.
- c. Expose aggregate to produce a \_\_\_\_\_ exposure.  
\*OR\*

*2.03.B.1.a Use reasonably acid resistant aggregates such as quartz or granite.*

*2.03.B.1.c (ligh) (medium) (deep).*

### 1. Exposed aggregate finish:

- a. Use power or hand tools to remove mortar and fracture aggregates at the surface of units (bushhammer).  
\*OR\*

*2.03.B.1.a Use with softer aggregates such as dolomite and marble.*

### 1. Exposed aggregate finish:

- a. Hand place large facing aggregate, fieldstone or cobblestones in sand bed over mold bottom.
- b. Produce mortar joints by keeping cast concrete  $\Omega$  in. to 1 in. from face of unit.  
\*OR\*

### 1. Sandblasted finish:

- a. Sandblast away cementitious materials-sand matrix to produce a \_\_\_\_\_ exposure.

*2.03.B.1.a (light) (medium) (deep). Exposure of aggregate by sandblasting can vary from 1/16 in. or less to over 3/8 in. Remove matrix to a maximum depth of one-third the average diameter of coarse aggregate but not more than one-half the diameter of smallest sized coarse aggregate. Depth of sandblasting should be adjusted to suit the aggregate hardness and size.*

\*OR\*

### 1. Honed or polished finish:

- a. Polish surface by continuous mechanical abrasion with fine grit, followed by special treatment which includes filling of all surface holes and rubbing.  
\*OR\*

*2.03.B.1 Honing and polishing of concrete are techniques which require highly skilled personnel. Use with aggregates such as marble, onyx, and granite.*

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1. Veneer faced finish:
    - a. Cast concrete over tile, brick, terra cotta or natural stone placed in the bottom of the mold.

2.03.B.1.a *Full scale mockup units with natural stone in actual production sizes, along with casting and curing of the units under realistic production conditions are essential for each new or major application or configuration of the natural stones.*
    - b. Connection of natural stone face material to concrete shall be by mechanical means.  
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2.03.B.1.b *Provide a complete bondbreaker between the natural stone face material and the concrete. Ceramic tile, brick and terra cotta are bonded to the concrete.*
  2. \_\_\_\_\_ back surfaces of precast concrete units after striking surfaces to flush form finish lines.

2.03.B.2 (Smooth float finish), (Smooth steel trowel), (Light broom), (Stippled finish). *Use for exposed back surfaces of units.*
- C. Cover:
1. Provide at least  $\approx$  in. cover for reinforcing steel.

2.03.C.1 *Increase cover requirements when units are exposed to corrosive environment or sever exposure conditions. For exposed aggregate surfaces, the  $\approx$  in. cover should be from bottom of aggregate reveal to surface of steel.*
  2. Do not use metal chairs, with or without coating, in the finished face.

2.03.C.2 *If possible, reinforcing steel cages should be supported from the back of the panel, because spacers of any kind are likely to mar the finished surface of the panel. For smooth cast facing, stainless steel chairs may be permitted. The wires should be soft stainless steel and clippings should be completely removed from the mold.*
  3. Provide embedded anchors, inserts, plates, angles and other cast-in items with sufficient achorage and embedment for design requirements.
- D. Molds:
1. Use rigid molds to maintain units within specified tolerances conforming to the shape, lines and dimensions shown on the approved shop drawings.
  2. Construct molds to withstand vibration method selected.

2.03.D.2 *Molds for architectural precast concrete should be built to provide proper appearance, dimensional control and tightness. They should be sufficiently rigid to withstand pressures developed by plastic concrete, as well as the forces caused by consolidation. Unless otherwise agreed in the contract documents, the molds are the property of the precast concrete manufacturer.*
- E. Concreting:
1. Convey concrete from the mixer to place of final deposit by methods which will prevent separation, segregation or loss of material.

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2. Consolidate all concrete in the mold by high frequency vibration, either internal or external or a combination of both, to eliminate unintentional cold joints, honeycomb and to minimize entrapped air on vertical surfaces.

### F. Curing:

1. Precast concrete units shall be cured until the compressive strength is high enough to ensure that stripping does not have an effect on the performance of the final product.

### G. Panel Identification:

1. Mark each precast panel to correspond to identification mark on shop drawings for panel location.
2. Mark each precast panel with date cast.

### H. Acceptance:

Architectural precast units which do not meet the color and texture range or the dimensional tolerances may be rejected at the option of the architect, if they cannot be satisfactorily corrected.

## 2.04 Concrete Testing

- A. Make one compression test at 28 days for each day's production of each type of concrete.

### B. Specimens:

1. Provide two test specimens for each compression test.
2. Obtain concrete for specimens from actual production batch.
3. 6 in. x 12 in. or 4 in. x 8 in. concrete test cylinder, ASTM C 31.  
\*OR\*
3. \_\_\_\_\_ sized concrete tube, \_\_\_\_\_.

## NOTES TO SPECIFIERS

*2.03.E.2 The prime objective is to consolidate the concrete thoroughly, production a dense, uniform product with fine surfaces, free of imperfections. Bonding between backup and face mix should be ensured if backup concrete is cast before the face mix has attained its initial set.*

*2.03.F A wide variation exists in acceptable curing methods, ranging from no curing in some warm humid areas, to carefully controlled moisture-pressure-temperature curing. Consult with local panel manufacturers to avoid unrealistic curing requirements.*

*2.03.F.1 Stripping strength, which could be as low as 2000 psi, should be set by the plant based on the characteristics of the product and plant facilities. It is the responsibility of the precaster to verify and document the fact that final design strength has been reached.*

*2.03.H It should be stated in the contract documents who the accepting authority will be—contractor, architect, engineer of record, owner or jobsite inspector.*

*2.04.A This test should be only a part of an in-plant quality control program.*

*2.04.B.1 One test specimen may be used to checked the stripping strength.*

*2.04.B.3 Specify size. Cube specimens are usually in 4 in. units, but 2 in. or 6 in. units are*

## GUIDE SPECIFICATIONS

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4. Cure specimens using the same methods used for the precast concrete units until the units are stripped, then moist cure specimens until tested.

C. Keep quality control records available for the architect upon request for two years after final acceptance.

### 3. EXECUTION

#### 3.01 Inspection

A. Before erecting architectural precast concrete, the general contractor shall verify that structure and anchorage inserts required to support panels are within tolerances.

B. Determine field conditions by actual measurements.

#### 3.02 Erection

A. Clear, well-drained unloading areas and road access around and in the structure (where appropriate) shall be provided and maintained by the general contractor to a degree that the hauling and erection equipment for the architectural precast concrete products are able to operate under their own power.

B. General contractor shall erect adequate barricades, warning lights or signs to safeguard traffic in the immediate area of hoisting and handling operations.

C. Set precast units level, plumb, square and true within the allowable tolerances. General contractor shall be responsible for providing lines, center and grades in sufficient detail to allow installation. General contractor shall verify that bearing surfaces comply with specifications and, if not in compliance, shall make necessary corrections prior to start of erection.

## NOTES TO SPECIFIERS

*sometimes required. Larger specimens give more accurate test results than smaller ones. Source: (molded individually), (sawed from slab).*

*2.04.C These records should include mix designs, test reports, inspection reports, member identification numbers along with data cast, shipping records and erection reports.*

*3.01.B Any discrepancies between design dimensions and field dimensions which could adversely affect installation in accordance with the contract documents should be brought to the general contractor's attention. If such conditions exist, installation should not proceed until they are corrected or until design requirements are modified. Beginning of installation can mean acceptance of existing conditions.*

*3.02.A General contractor should coordinate delivery and erection of precast concrete products with other jobsite operations.*

*3.02.C Controlled reference lines should be used because the characteristics of precast concrete make a surface elevation difficult to define. Where thickness is not of exact concern, lines used in erection should be controlled from exposed exterior precast concrete surfaces.*

## GUIDE SPECIFICATIONS

- D. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
- E. Tolerances for location of precast units shall be in accordance with Chapter 8 of this Handbook.
- F. Set non-load bearing units dry without mortar, attaining specified joint dimension with steel or plastic spacing shims.
- G. Fasten precast units in place by bolting or welding, or both, completing drypacked joints, grouting sleeves and pockets, and/or placing cast-in-place concrete joints as indicated on approved erection drawings.
- H. Temporary lifting and handling devices cast into the precast concrete units shall be completely removed or, if protectively treated, left in place unless they interfere with the work of any other trade.

### 3.03 Repair

- A. Repair exposed exterior surface to match color and texture of surrounding concrete and to minimize shrinkage.
- B. Adhere large patch to hardened concrete with bonding agent.

## NOTES TO SPECIFIERS

*3.02.F Shims should be near the back of the unit to prevent their causing a spall on face of unit when shim is loaded. The selection of the width and depth of field-molded sealants, for the computer movement in a joint, should be based on the maximum allowable strain in the sealant.*

*3.02.G The erector should protect units from damage caused by field welding or cutting operations and provide non-cumbustible shields as necessary during these operations. Structural welds should be made in accordance with the erection drawings which should clearly specify type, extent, sequence and location of welds. Adjustments or changes in connections, which could involve additional stresses in the products or connections, should not be permitted without approval by the architect/engineer. Precast concrete units should be erected in the sequence indicated on the approved erection drawings.*

*3.03.A Repair is normal accomplished prior to final cleaning and caulking. It is recommended that the precaster execute all repairs or approve the methods proposed for such repairs by other qualified personnel. The precaster should be compensated for repairs of any damage for which he is not responsible. Repairs should be acceptable providing the structural adequacy of the product and remedial work should be documented and kept in job record files.*

## GUIDE SPECIFICATIONS

## NOTES TO SPECIFIERS

### 3.04 Cleaning

- A. After installation and joint treatment: \_\_\_\_\_ shall clean soiled precast concrete surfaces with detergent and water, using fiber brush and sponge, and rinse thoroughly with clean water in accordance with precast concrete manufacturer's recommendation.

\*OR\*

- A. After installation and joint treatment: Clean precast concrete panels with \_\_\_\_\_.

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- B. Use acid solution only to clean particularly stubborn stains after more conservative methods have been tried unsuccessfully.
- C. Use extreme care to prevent damage to precast concrete surfaces and to adjacent materials.
- D. Rinse thoroughly with clean water immediately after using cleaner.

### 3.05 Protection

- A. All work and materials of other trades shall be adequately protected by the erector at all times.
- B. A fire extinguisher, or an approved type and in operating condition, shall be located within reach of all burning and welding operations at all times.
- C. The erector shall be responsible for any chipping, spalling, cracking or other damage to the units after delivery to the jobsite unless damage is caused in site storage by others. After installation is completed, any further damage shall be the responsibility of the general contractor.

*3.04.A State whether erector or precaster should do cleaning under the responsibility of general contractor. Use cleaning materials or processes which will not change the character of exposed concrete finishes.*

*3.04.A (acid-free commercial cleaners), (steam cleaning), (water blasting), (sandblasting). Select cleaners with a non-chloride base. Use sandblasting only for units with original sandblasted finish. Ensure that materials of other trades are protected when cleaning panels.*

*3.05.C After erection of any portion of precast concrete work to proper alignment and appearance, the general contractor should make provisions to protect all precast concrete from damage and staining.*

# GUIDE SPECIFICATIONS FOR ARCHITECTURAL PRECAST CONCRETE

The enclosed “**Guide Specification for Architectural Precast Concrete**” is excerpted from the *PCI Design Handbook, Fifth Edition*, published by the Precast/Prestressed Concrete Institute\*. **Please insert it in the Morse Bros., Inc. *Prestressed Concrete Source Book* under ARCHITECTURAL PRECAST.**

The “**Guide Specification for Architectural Precast Concrete**” is to be used by project designers/specifiers for architectural applications of wall panels, spandrel panels, wall caps, and other products where the aesthetic qualities of form, color, and texture are a primary consideration.

Additional specifications that apply to specific products and structures can be found in other sections of the *Morse Bros. Prestressed Concrete Source Book*. For further information, please contact the following:

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\*The *PCI Design Handbook, Fifth Edition*, can be purchased by contacting the Precast/Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, IL, 60606. Phone: (312) 786-0300 Fax: (312) 786-0353