

Mid-States Concrete Industries
STRUCTURAL PRECAST CONCRETE SPECIFICATIONS-HOLLOW CORE

PART 1 GENERAL

1.1 DESCRIPTION

- A. This specification covers the design, manufacture, transportation and erection of plant precast structural concrete units, including the following:
 - 1. Hollow core plank (Elematic, 4' hollow core)

1.2 PERFORMANCE REQUIREMENTS

- A. Design: Design precast structural concrete units, including comprehensive engineering analysis under the direct supervision of/or by a qualified professional engineer registered in the state where the project is located, using performance requirements and design criteria indicated by the contract documents.
- B. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions set forth by the Architectural/Structural plans.
 - 1. Design precast structural concrete units and connections to allow for fabrication and construction tolerances.
 - 2. Design precast structural units to resist handling, transportation and erection stresses.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years after completion of structure.
- B. Design Mixtures: For each concrete mix design, compressive strength test results are available upon request.
- C. Design Submittal: Fabricator's engineer has design responsibility, and shall prepare and seal all drawings and calculations, to comply with performance requirements and design criteria, for submittal. Submit design calculations to architect/contractor.

- D. Fabricator's Drawings: Include unit locations, plans, dimensions, shapes and sections, openings, and support conditions.
 - 1. Indicate welded connections by AWS standard symbols. Show size, length, and type of each weld.
 - 2. Detail loose and cast-in hardware, connections, and joints.
 - 3. Indicate locations and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 4. Include and locate openings. Core drilled holes not included.
 - 5. Indicate location of each precast structural concrete unit.
 - 6. Indicate relationship of precast structural concrete units to adjacent materials.
 - 7. Indicate design loads and applicable fire ratings.

- E. Product Samples:
 - 1. Exposed to view hollow core, a sample approval must be met.

- F. Welding Certificates. Available upon request.

- G. Material Certificates: Available upon request.
 - 1. Cementitious materials
 - 2. Reinforcing materials and prestressing tendons.
 - 3. Admixtures.
 - 4. Aggregates, fine and coarse.
 - 5. Other materials

- H. Material Test Reports: Available upon request.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in manufacturing the work of this section within 5 years documented experience.

- B. Participates in PCI's Plant Certification program and is designated a PCI-certified plant as follows:
 - a. Group A1, C3A, B3, B3-IL certified

- C. Erector Qualifications: A precast concrete PCI Qualified Erector to erect Category S2.

- D. Design Standards: Comply with ACI 318, design recommendations in PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete," and Hollow Core Manual PCI MNL 126 applicable to types of precast structural concrete units indicated.

- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D.1.1M, "Structural Welding Code – Steel."
 - 2. AWS D1.4, "Structural Welding Code – Reinforcing Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
 - 3. Store units with dunnage across full width of each bearing point unless otherwise indicated.
 - 4. Place adequate dunnage of even thickness between each unit.
 - 5. Place stored units so identification marks are clearly visible, and units can be inspected.
- C. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that would cause cracking or damage.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Forms: Rigid, dimensionally stable, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Form-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 or precast concrete.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

- B. Low-Alloy-Steel Reinforcing Bars; ASTM A 706/A 706M, deformed.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- E. Supports: Non-staining bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement will be in place according to PCI MNL 116.

2.3 PRESTRESSING TENDONS

- A. Pretensioning Strand: ASTM A 416, Grade 250ksi/270ksi, uncoated, 7-wire strand.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type III, gray.
 - 1. For exterior surfaces exposed to view in finished structure, gray cement, conforming to ASTM C 150.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C.
 - 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Aggregates:
 - 1. Coarse Aggregates; Selected, hard, and durable; free of material that reacts with cement.
 - a. Gradation: Uniformly graded, to meet mix design requirements.
 - 2. Fine Aggregates: Selected, natural sand.
 - a. Gradation: Uniformly graded, to meet mix design requirements.
- D. Water: Complying with chemical limits of PCI MNL 116.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water- Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing and Retarding Admixture; ASTM C 1017/C 1017M.
8. Air Entrainment: Air entraining admixture SHALL NOT be added. As noted in the PCI Manual for Design of Hollow Core Slabs 2nd Edition; "Air entrainment admixtures are not effective in dry mix concrete.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36.
- B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
- C. Malleable-Iron Castings: ASTM A 47.
- D. High-Strength, Low-Alloy Structural Steel: ASTM A 572.
- E. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
- F. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706.
- G. Carbon-Steel Bolts and Studs; ASTM A 307, Grade A: carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563; and flat, unhardened steel washers, ASTM F 844.
- H. Zinc-Coated Finish: For exterior steel items exposed to weather and items indicated for galvanizing, apply zinc coating by cold galvanizing or hot-dip process according to ASTM A123.
- I. Welding Electrodes: Comply with AWS standards.
- J. Precast Accessories: Provide hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.6 BEARING PADS

- A. High-Density Plastic: Korolath, nonleaching, plastic strip.

2.7 GROUT MATERIALS

- A. Sand-Cement Grout Mix to achieve minimum required design strength.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Tertiary or Binary mix designs including Type III Portland cement, Class C Fly Ash and Blast Furnace slag will meet compressive strength design requirements as set by fabricator's design engineer.
- B. Design mixtures are prepared by qualified precast plant personnel.
- C. Concrete Mixtures: With the following property:
 - 1. Compressive Strength (28 Days): Per design requirements.
- D. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.9 FORM FABRICATION

- A. Form fabrication procedures shall be in general compliance with PCI MNL-116.
- B. Forms: Accurately construct forms of sufficient strength to withstand pressures due to concrete-placement operations and for prestressing and detensioning operations. Coat contact surfaces of forms with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- C. Maintain forms to provide complete precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Standard Edge and Corner Treatment:
4 foot wide hollow core – 1/2", 45 degree chamfer

2.10 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Install anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1. 1/D1. 1M and AWS C5.4, "Recommended Practices for Stud Welding."

- B. Furnish loose hardware items including steel plates, anchors, dowels, clamps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in openings:
 - 1. Notches for columns only.
 - 2. Other openings cast in during fabrication will be provided at fabricator's engineering and material handling discretion.
- D. Field cut openings:
 - 1. Openings not made during the fabrication process and greater than 14" in any direction will be field cut.
- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
 - 1. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations.
 - 2. Place reinforcement according to engineering specifications. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 3. Place reinforcing steel and prestressing strand to maintain at least ¾-inch minimum concrete cover unless otherwise specified by engineering and/or for production purposes
 - 4. Install welded wire fabric in lengths as long as practical. 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. Prestress tendons for precast structural concrete units by pretensioning methods. Comply with PCI MNL 116.
 - 1. Delay detensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by PCI MNL 116 methods.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- G. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete.
- H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

- I. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance of final product.
- J. Make necessary repairs to precast units according to PCI MNL 116 to meet the structural, manufacturing tolerance and finish requirements. If after review by the design engineer it is determined the precast concrete unit cannot be adequately repaired, discard and replace the precast structural concrete unit.

2.11 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product dimension tolerances.

2.12 FINISHES

- A. The following descriptions are set out in PCI MNL 116 and apply to surface finishes of precast structural concrete hollow core slabs.
- B. Unformed surface:
 - 1. As cast machine finish.
- C. Formed surface:
 - 1. Standard Grade: product is exposed to view but the function of the structure does not require a special finish. This is the typical finish grade for all structural products. Small surface holes caused by air bubbles ("bug-holes"), normal color variations, normal form joint marks and minor chips and spalls are considered acceptable. No bug-holes larger than 1/2" in any direction should be permitted. Bug-holes between 1/4" and 3/8" in width that occur in high concentration (more than one per 2" squared) should be filled.

2.13 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements.
- B. Strength of precast structural concrete units will be considered deficient if units fail to comply with the design engineer's compressive strength requirements for each product type.

- C. When there is evidence that the strength of precast concrete units may be deficient based on cylinder breaks, the precaster may conduct further testing approved by a structural engineer to prove these units are not deficient, but acceptable for use in the project.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Review site conditions for installation readiness.
- B. Proceed with installation only after unsatisfactory conditions have been corrected by the responsible contractor.

3.2 INSTALLATION

- A. Install hangers, bearing pads, dowels, anchors and other accessories required for connecting precast structural concrete units to supporting members and backup materials as shown on fabricator's drawings.
- B. Erect precast structural concrete level, plumb, and square within PCI MNL 127 tolerances. For the precast units only, provide temporary structural framing, supports, and bracing as required to maintain position, stability, and alignment of precast units until permanent connection.
- C. Connect precast structural concrete units in position by welding, grouting, or as otherwise indicated on fabricator's drawings.
- D. Field cutting of precast units is not permitted without approval of the precast supplier.
- E. Fasteners: Drilled fasteners may be used for attaching accessory items to precast, prestressed concrete units. Do not cut reinforcing. Powder actuated fasteners are not to be used with hollow core plank.
- F. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Clean weld-affected steel surfaces with chipping hammer followed by brushing.

3. Remove, reweld, or repair incomplete and defective welds.
- G. Grouting: Grout connections and joints and open spaces at keyways as indicated on fabricator's drawings. Retain grout in place until hard enough to support itself.
1. Place grout to finish level when wet. Hollow core grout joints will show shrinkage and indentations at top of joints.
 2. Fill joints completely without seepage to other surfaces.
 3. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
 4. Tuck-pointing or dry packing at lap and bearing conditions excluded.

3.3 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 127.
- B. Minimize variations between adjacent slab members as recommended by fabricator.

3.4 REPAIRS

- A. Repair precast structural concrete units according to PCI MNL 116.
 1. Repairs will be permitted when structural adequacy of units has not been impaired.
- B. Mix patching materials and repair the units so cured patches blend with texture and relative smoothness of adjacent exposed surfaces.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with structural requirements as determined by the fabricator's design engineer.

3.5 CLEANING

- A. By others:
 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.

2. Do not use cleaning materials or processes that could affect the structural integrity of the precast concrete unit or damage adjacent materials.
3. Snow removal: do not use calcium chloride material for melting snow and ice

END OF SECTION