

PART 1 General

1.1 DESCRIPTION OF WORK

The work includes, but is not limited to :

1. Architectural precast concrete
2. Structural design, fabrication, delivery
3. Connections, including anchorage devices attached to structural framing

1.2 SUBMITTALS

A. Product Data:

Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used.

B. Mix Design:

Submit concrete mix design. Engage services of a concrete technician approved by Architect and having access to suitable laboratory facilities. Precaster may use his own laboratory facilities, if adequate and the services of a technician regularly in his employ for such duties. Confirm mix designs by tests on trial mixes made with proposed materials. Provide mix design and trial mixes sufficiently in advance so that seven day compression test results will be available prior to first production of precast units.

C. Shop Drawings:

Submit large scale Shop Drawings for fabrication and erection of all parts of the work. Provide plans, elevations, and details of anchorage, connections, lifting devices, and accessory items. Provide installation templates for work installed by others. Provide information on erection sequence with plans coded to numbered precast units. Provide Shop Drawings stamped and sealed by a Professional Engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

D. Erection Drawings:

Provide detailed Drawings, properly checked and coordinated with existing conditions showing precast design including supports, anchors, connections and attachments. For items installed in work by others, include setting diagrams, templates, and instructions. Erection Drawings may be incorporated into Shop Drawings.

E. Samples:

Submit minimum 12 in. x 12 in. samples of each finish that is to be exposed in the finished work. Proposed samples shall be fabricated and shall demonstrate the precast concrete producer/fabricators ability to closely match the color, texture, and finish of the Owner's mockup prior to award of Contract.

F. Manufacturer's Certification:

Prior to beginning work, manufacturer shall submit written certification that they have sufficient stone, sand, and cement on-site to complete the entire project, producing panels which are uniform in appearance.

Approved Manufacturer(s):

Bétons Préfabriqués du Lac Inc.
890 rue des Pins Ouest
Alma (Québec) G8B 7R3
Phone: 418-668-6161
Contact: Robert Bouchard
rbouchard@bpdf.com

G. Test Reports:

Submit certified reports for tests required.

H. Referenced Standards:

Submit copies of referenced standards for permanent availability in Contractor's site office.

I. Fabrication Schedule:

Prior to commencement of fabrication, submit fabrication schedule to Architect so that plant inspection plan can be prepared. Do not transport panels to site until they have been accepted by Architect's representative.

1.3 TESTING AND INSPECTION

A. Testing by Independent Agency:

Materials and workmanship furnished under this Section are subject to inspection and testing in plant and field by Architect and an independent testing agency, approved by Architect, selected and paid for by Owner, as specified in Section 01400. Such inspection and testing shall not relieve Precaster of responsibility to furnish materials and workmanship in accordance with requirements of Contract Documents.

B. Testing by Precaster:

Supply and place concrete of specified strength and quality. Provide and pay for compression tests. Submit results of tests to Architect. Provide a minimum of one test for each day's pour, with each test consisting of four cylinders, one (1) of which to be broken at 7-days, two (2) at 28-days, and one (1) at a time selected by Precaster. Sampling, molding, curing and testing of the cylinders shall conform with ASTM C 31 and ASTM C 39, under laboratory conditions.

1.4 QUALITY ASSURANCE

A. Provide precast concrete work conforming to ACI 318, Chapter 16, and PCI MNL-122. Plant quality control program shall comply with PCI MNL-117.

B. Precaster/Installer: Firms with a minimum of 5 years successful experience in fabrication of architectural precast concrete units required for this Project. Precaster must have sufficient production capacity to produce, transport, and deliver required units without causing delay in the work.

Approved manufacturer: Bétons Préfabriqués du Lac Inc. (Tel.: 418-668-6161) or equal.

C. Maintain profiles shown without increasing or decreasing sizes of members or altering alignment shown.

D. Final acceptance of each member will be subject to approval by the Architect as based upon full conformance with these Specifications. Members shall be made accessible and fully visible to the Architect for inspection at the plant prior to shipment and/or at the site after shipment. Rejected members shall be immediately removed from the site and plant storage areas.

1.5 PERFORMANCE REQUIREMENTS

A. *Precast Concrete Compressive Strength*: Minimum 5,000 psi at 28 days when tested in accordance with ASTM C 39.

B. *Water Absorption by Weight of Concrete*: 5% maximum for individual units and 4-1/2% maximum, as an average.

C. *Tolerances*: Architectural precast concrete units shall be true to dimension, not more than 1/16 in. in 10 feet out of plane, and completely without twists or bends. Arrises shall be sharp, whole, and clearly defined. Dimensions shall be held within a tolerance of plus zero (0) and minus 1/8 in.

D. *Design*: Precast contractor shall design and detail all architectural precast concrete units and their connections to the structural frame in accordance with all applicable loadings specified in the applicable Building Code. Provide complete structural design calculations for all different types of units, indicating that the precast concrete units can safely withstand stresses induced due to dead loads, wind loads, seismic loads, and temperature loads. The design of the units shall also take into account stresses induced due to shrinkage, fabrication, handling, and erection of the units. All calculations shall be prepared under the supervision of a registered Professional Engineer who will furnish certification stating that the precast units design provided by the precast contractor, meet or exceed the requirements of the Contract Documents.

1.6 LEED MATERIAL PERFORMANCE CRITERIA

The following criteria are required for products included in this Section:

A. Steel reinforcement shall contain a minimum of 65% recycled content (combined pre and post-consumer) and shall be documented in accordance with the LEED Submittal Requirements.

B. Materials that are both manufactured and harvested or extracted within 500 miles (by air) of the project site shall be documented in accordance with the LEED Submittal Requirements.

C. Certification of these products shall be in accordance with the LEED Submittal Requirements.

* All design mixes are subject to review and approval by Structural Engineer.

1.7 HANDLING, TRANSPORTATION, AND STORAGE

Deliver, store and handle precast in strict compliance with fabricator's instructions and recommendations and industry standards. Protect from all possible damage. Lift and support units only at designated lifting points as shown on approved shop drawings.

Sequence deliveries to avoid delays, but minimize on-site storage.

PART 2 Products

2.1 FORMWORK

- A. Comply with applicable requirements of ACI 347, and with PCI requirements. Provide form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.
- B. Construct formwork accurately, mortar-tight, and of sufficient strength to withstand pressures due to concrete placement, and temperature changes.
- C. Coating: Coat forms with approved non-staining form release agent that will not interfere with adhesion of sealants, glazing compound, insulation adhesives or applied finishes. Do not use castor oil or form release agents containing castor oil or retardants.
- D. Formwork Joints: Seal joints in formwork with gaskets, silicone sealant, or other method approved by the Architect to provide acceptable finish.
- E. Forms may be designed with a draft of 1/8 in. in 12 in., and all forms may have 1/8 in. radius corners to facilitate removal and reduce breakage.
- F. Clean forms thoroughly after each use and prior to reuse. Check forms for tightness at each usage.

2.2 REINFORCEMENT

- A. Reinforcing Bars: ASTM A 775 galvanized.
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- C. Reinforcing Supports: Provide reinforcing supports, including bolsters, chairs, spacers, and other devices for fastening, spacing, and supporting reinforcing.
- D. Place reinforcement dowels securely and accurately as shown on the approved submittals. Attach connection hardware rigidly to forms.
- E. Detail and fabricate reinforcement in conformance with ACI 315 and ACI 315R.
- F. Place reinforcement on accessory bolsters and chairs with plastic tips of color to match finished concrete. Accessories shall be galvanized and have plastic tips. Splicing of bars shall be as specified in ACI 318.
- G. Provide minimum 1 in. coverage of reinforcing steel, including ties. Assembly and placing of reinforcing shall ensure minimum coverage being maintained during the placing, consolidating, and curing of concrete.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, white color.
- B. Water: clean, clear, potable and free from deleterious chemicals and substances.
- C. Coarse Aggregate: ASTM C 33, specially selected for color, supplied from a single source for entire Project. Provide aggregate washed, clean, hard and durable, inert, material, free of staining or deleterious material.
 - 1. Aggregate Gradation and Color: White, as required to match approved sample.
- D. Fine Aggregate: ASTM C 33 manufactured sand of same material as coarse aggregate, unless approved otherwise by Architect.
 - 1. Aggregate Gradation and Color: White, as required to match approved sample.
- E. Coloring Admixtures : ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, non-fading, and alkali resistant.

- F. **Air-Entraining Admixtures:** ASTM C 260, manufacturer and product as approved by Architect.
- G. **Water Reducing Admixtures:** ASTM C 494, Type A, manufacturer and product as approved by Architect.
- H. **Pigment to be used:** ASTM C-979 417 Red color, to achieve a red terrazzo color.

2.4 GROUT MATERIALS

Non-Metallic, Non-Shrink Grout: Provide one of the following, or Architect approved equal:

1. Euco N.S.; Euclid Chemical Co.
2. Masterflow 713; Master Builders.
3. Five Star Grout; U.S. Grout Corp.

2.5 CONCRETE MIX

- A. **Submit proposed concrete mix proportions to Architect for approval prior to fabrication. Show batch weights, gradations, specific gravity, absorption of aggregates, slump, fresh unit weight and air content. Verify mix design and provide four (4) compression tests, two (2) at 7-days, and two (2) at 28-days, on 6 in. diameter x 12 in. high cylinders filled with proposed mix materials in proposed proportions.**
- B. **Proportion mixes by either laboratory trial batch of field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 318.**
- C. **Concrete Mix: Standard weight concrete consisting of specified Portland cement, aggregates, admixtures, pigment, and water to produce the following properties:**
 1. Compressive Strength: 5,000 psi minimum at 28-days.
 2. Total Air Content: Not less than 4% nor more than 6%.
 3. Slump: 3 in. minimum, 5 in. maximum.
- D. **Submit written reports to Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluation have been reviewed by Architect.**
- E. **Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the work.**
- F. **Admixtures: Use admixtures in strict compliance with manufacturer's instructions. Adjust admixture quantities as required to maintain quality control.**

2.6 FABRICATION

- A. **General: Design and fabricate precast concrete units to comply with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-117, unless otherwise indicated.**
- B. **Fabricate units straight, smooth, and true to size and shape, with exposed edges and corners precise and square unless otherwise indicated.**
- C. **Refer to Structural Drawings for additional reinforcing and fabrication requirements. Provide prefabricated reinforcing cages, wire tied or welded as required, inside each unit having total area of steel in each direction not less than 0.0025 times the area of concrete (in section). Provide two (2) layers of reinforcement per panel. Hang reinforcement from rear, or use other Architect approved method, to prevent reinforcement supports from touching surfaces exposed to view and weather.**
 - * All face reinforcing shall be hot-dipped galvanized.
- D. **Built-In Items: Provide reglets, slots, holes, embeds, anchors, window tie-back buttons, and other accessories in units to receive windows, cramps, dowels, reglets, waterstops, flashings, light fixtures and other similar work as indicated. Provide all necessary cast in embeds and anchors.**

E. Concrete Mixing: Comply with requirements of PCI MNL-117.

1. Measure water used in mixing to an accuracy of 0.5% using a calibrated measuring device. Measure all cement and aggregate materials by weight to an accuracy of 1%.
2. Use admixtures and pigments in strict compliance with manufacturer's instructions and recommendations; use amounts accepted in approved mixed designs to obtain performance criteria indicated.
3. Mix concrete for at least 60 seconds in a mechanical mixer. Place concrete promptly after mixing; discard mixed concrete after 1 hour.
4. Handle and place concrete to avoid segregation, honeycombs, and migration of air. Vibrate to ramp concrete to consolidate, but not to move concrete within forms.

F. Curing: After removal from forms, cure precast panels in strict compliance with PCI MNL-117. So not permit curing units to become damaged by loss of moisture or staining and dripping. After precast units have cured enough to prevent uncontrolled erosion during finishing process, lightly sand blast all surfaces indicated to receive "smooth" finish. Do not over blast to such and extent that large aggregates become more exposed than in approved sample. Control blasting to prevent arrises and reveals from losing sharpness and definition.

1. Size of finished units shall be within tolerances prescribed in PCI MNL-117.

G. Repairs: Surface defects may be repaired when acceptable to the Architect and when indistinguishable in finish, color, texture and quality from acceptable unrepaired surfaces. Demonstrate repair techniques, including curing; obtain Architect's approval of repair results before continuing work. Replace units that cannot be repaired as specified.

1. It is intended that any required repairs be made in the fabrication plant prior to delivery of units to jobsite. Surface damage occurring after units have left the plant may be repaired in the field only with Architect's approval; units that the Architect deems irreparable in the field may be rejected.
2. Determine repair mix formulas by trial to obtain finish, color, and texture match when both repaired and acceptable unrepaired concrete are cured and dry.
3. Fill holes, if any, using the same source of cement, sand, and pigment used in the parent concrete.
4. Touch up textured surfaces as necessary.

H. Predelivery Cleaning: Clean objectionable stains or sports off units as directed by the Architect using brushes, soap and clean, running water before delivery to site. Acid cleaning is not acceptable unless approved by Architect.**I. Identification: Mark each unit on a surface concealed from view in final installation with a non-staining, non-migrating paint. Coordinate marking with approved erection drawings.**

2.7 APPEARANCE AND FINISH

Architectural Precast Units: Provide polish texture and uniform color as acceptable to the Architect per approved samples.