



# Design and Construction Responsibilities for Architectural Precast Concrete

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Design and construction with architectural precast concrete are simplified when all parties are working as cooperative partners. Clearly defining the scope of work and the responsibilities of the involved parties by means of the contract documents is critical to achieving a high-quality structure. This article provides a guide for all parties involved in a precast concrete project and defines the responsibilities of each party. These responsibilities and relationships between the parties should be defined in the contract documents for a particular project.

A successful precast concrete project requires teamwork—close cooperation and coordination among all of the participants, including the owner, architect, structural engineer of record (SER), precast concrete manufacturer, erector, general contractor (GC)/construction manager (CM), and all other parties involved. The scope of the precast concrete work and the responsibilities of each party should be established at an early stage in the development of a project to achieve the desired quality and keep the project on schedule (see Table 1). During construction, each party is responsible for communicating with all other parties through the GC/CM or architect. This helps prevent misunderstandings and confusion. When authority and responsibility roles are coordinated, consistent, and clearly defined by the contract documents, problems and conflicts are avoided. Local practices regarding the assignment and acceptance of responsibility in design and construction can vary.

One of the basic principles of the construction industry is that with the responsibility for any aspect of design or construction must go the authority for that aspect. Another principle is that every entity should be responsible for its own work. These principles are frequently not followed in practice. There have been cases where owners have sued architects or engineers for approving nonconforming work without giving them authority to monitor the work as it progressed. Safety enforcement agencies (OSHA) and plaintiffs' lawyers have charged engineers or architects with the responsibility for construction accidents contrary to language and responsibilities in the contract documents. These last two situations typically are cases of responsibility without authority, although there could be instances where a design team's work or direction can affect jobsite safety. If the design team is involved with construction-management functions, they could be making decisions affecting worker safety as well as quality of

construction. When agents of the owner give instructions directly to the construction workforce regarding how work is to be performed, they step over the line into the contractor's area of responsibility.

In order for architects to design economical structures for their clients, it is imperative that the designer become familiar with architectural precast concrete and obtain design input from a local precaster early in the schematic design process. The precaster will help inform the design and construction team regarding economical fabrication, delivery, and erection processes. In the event alternatives are approved, the design team retains responsibility for properly interfacing with other materials in contact with or adjacent to the precast concrete.

The SER always has to take overall responsibility for the structural design of the completed structure. However, certain aspects of the design are often delegated to specialty structural engineers (SSEs) working for the material suppliers or subcontractors. When any of this delegated structural design work for a portion of the structure involves engineering (as opposed to simply detailing), the design work should be reviewed and approved by the SER registered in the same state as the project or as required by the local jurisdiction. The SER then accepts responsibility for the overall structural design. Additionally, local regulatory authorities should be consulted for their specific requirements. Contract documents typically require the structural design be the responsibility of a professional engineer, regardless of conflicts with other governmental requirements.

## Responsibilities of the Architect

The architect develops the project design concept, establishes overall structure geometry, selects the wall materials for appearance and function, provides details and tolerances for proper material interfacing and weatherproofing, and specifies performance and quality characteristics, as well as inspection and testing requirements in the contract documents.

## Table 1 Design Responsibilities

Contract Information Supplied by Design Team	Responsibility of the Precaster
Option I	
<p>Provide complete drawings and specifications detailing all aesthetic, functional, and structural requirements, including design criteria, plus dimensions.</p>	<p>The precaster should make shop drawings (erection and production drawings) as required, with details as shown by the designer. Modifications may be suggested that, in precaster's estimation, would improve the economics, structural soundness, or performance of the precast concrete installation. The precaster should obtain specific approval for such modifications. Full responsibility for the precast concrete design, including such modifications, remains with the designer. Alternative proposals from a precaster should match the required quality and remain within the parameters established for the project. It is particularly advisable to give favorable consideration to such proposals if the modifications are suggested so as to conform to the precaster's normal and proven procedures.</p>
Option II	
<p>Detail all aesthetic and functional requirements but specify only the required structural performance of the precast concrete units. Specified performance should include all limiting combinations of loads together with their points of application. This information should be supplied in such a way that all details of the unit can be designed without reference to the behavior of other parts of the structure. The division of responsibility for the design should be clearly stated in the contract documents.</p>	<p>The precaster has two alternatives:</p> <p>(a) Submit erection and shape drawings with all necessary details and design information for the approval and ultimate responsibility of the designer.</p> <p>(b) Submit erection and shape drawings and design information for approval and assume responsibility for the panel structural design; that is, the individual units, but not their effect on the building. Precasters accepting this practice may either stamp (seal) drawings themselves, or commission engineering firms to perform the design and stamp the drawings.</p> <p>The choice between alternatives (a) and (b) should be decided between the designer and the precaster prior to bidding, with either approach clearly stated in the specifications for proper allocation of design responsibility.</p> <p>Experience has shown that divided design responsibility can create contractual problems. It is essential that the allocation of design responsibility is understood and clearly expressed in the contract documents.</p>
Option III	
<p>Cover general aesthetic and performance requirements only and provide sufficient detail to define the scope of the precast concrete work.</p>	<p>The precaster should participate in the preliminary design stage and the development of the final details and specifications for the precast concrete units and should work with the design team to provide an efficient design. The precaster provides the engineering design of the precast concrete units and their connections to the structure and should work with the design team to coordinate the interfacing work. The precaster should submit design information for approval and shop drawings at various stages of completion for coordination with other work.</p>

The architect and SER have a responsibility to coordinate the design aspects of the precast concrete panels, such as aesthetics, dimensions, and loads to structure. The architect or SER may specify in the contract documents that design services for portions of the work are to be provided by the precaster. Typically design services are performed for the precaster by a licensed engineer who can be an employee of the precaster or an independent structural engineer, who serves as the SSE. The contract documents should clearly define the scope of the precast concrete design requirements and review responsibilities, as well as the responsibilities of other parties providing design services.

The contract drawings prepared by the design team should provide the overall geometry and dimensions of the structure, member or panel dimensions and cross sections, typical connection locations and details, and concepts so all precasters are estimating based on the same information. The architect's drawings may only show reveals or design articulation, allowing the precaster to determine panel sizes suitable to their handling and erection capabilities. In addition, the contract documents (specifications and design drawings) also should provide the general performance criteria, design loads (including concrete strength requirements), deflection requirements, temperature considerations, and any tolerance or clearance requirements for proper interfacing with other elements of the structure.

The order in which the project contract, specifications, or drawings prevail in the event of conflicts should be clearly defined. All aesthetic, functional, and structural requirements should be detailed.

The design team should provide complete, clear, and concise drawings and specifications. Contract documents should clearly define: (1) precast concrete components that are to be designed by the precaster (state who takes responsibility for design of elements at interfaces with other parts of the structure, such as the secondary steel bracing of the structure, to prevent rotation of beams or columns); (2) details or concepts of supports, connections, and clearances that are part of the structure designed by the design team and that will interface with the precast concrete components; and (3) permissible design load transfer points, indicating generic connection types to avoid having the precaster make assumptions on connection types and piece counts during bidding and design. It is preferable to leave specific panel and connection design to precasters so they can design details and connections suitable for their production and erection techniques.

The architect and SER should review designs, calculations, and shop drawings submitted by the precaster for conformance with design criteria, loading requirements, connection points, and design concepts as specified in the contract documents. This review, however, does not relieve the precaster and the precast concrete engineer of their design responsibilities.

## Key Design Issues for the Design Team

The contract drawings prepared by the design team should provide a clear representation of the configurations and dimensions of individual precast concrete units and their relationship to the structure and to other materials. Contract documents that are unclear and lack detail may extend shop drawing preparation time, lead to confusion over work scope, and impact the project schedule.

The contract documents should supply the following information:

- Governing building codes, design loads, deflection limitations and temperature considerations;
- Elevations, wall sections, and dimensions necessary to define the sizes and shapes (profiles) of each different type of precast concrete element;
- Locations of joints and reveals, real (functional) or false (aesthetic), and drips;
- Required materials, color and finish treatment for all surfaces with a clear indication of the extent of all surfaces to be exposed to view when installed;
- Corner and return details;
- Details for jointing and interfacing with other materials (coordinated with the general contractor), including windows, roofing, and other wall systems;
- Insulated panel construction and insulation systems independent of the precast concrete;
- Openings for services and equipment, with their rough opening size and location;
- Details for special or unusual conditions including fire endurance requirements;
- Specified dimensional tolerances for the precast concrete and the supporting structure, location tolerances for the contractors' hardware, clearance requirements, and erection tolerances for the precast concrete. Exceptions to PCI MNL-117 or MNL-135 tolerances are not recommended;
- Support locations for gravity and lateral loads, as well as supplemental framing or bracing to support the precast concrete;
- Building location and site access; and
- Delineation of lateral bracing for structural beams.

The precaster uses the information from the contract drawings and documents to generate shape and erection drawings and design calculations. These drawings should detail elevations showing panel sizes, surface features, and panel relationships; detail sheets should show panel cross sections, special edge conditions, and feature details and should specify connection de-

tails showing mechanisms and locations of load transfers to the supporting structure. Allowing the precaster to suggest configurations of the precast concrete units and to select which joints are false and which are real (panelization) will achieve greater economy and flexibility in production and erection.

The design team should review shop drawings in a timely manner to ensure their general conformance with the contract documents, to avoid delay in the project schedule, and to respond to aesthetic questions raised by the construction team. Architectural and structural review and clarification of dimensions and detailing should be anticipated. Following this review, the precaster will make the appropriate revisions to the shop drawings. Open discussion between the architect and precaster should be allowed and encouraged in order to achieve the best possible design for the project.

Producing small mockups is encouraged to help verify the appearance of the completed facade and clarify actual field-construction techniques and material interface issues. If the units have returns, the same size return should appear in the mockup panels.

The architect establishes the standards of acceptability for surface finish, color range, and remedial procedures for production and construction defects and damage. This can be best accomplished by the precaster producing at least three sample panels, 15 to 20 ft<sup>2</sup> (1.4 to 1.9 m<sup>2</sup>) each, before the initial production to establish the range of acceptability with respect to color and texture variations, surface blemishes, and overall appearance. In addition the architect should visit the plant early in production to evaluate conformance with approved samples.

Panel-to-panel joint design and the proper sealing at windows and other penetrations in the exterior wall are necessary to prevent air and water infiltration. The architect is responsible for providing these designs and details. Precast concrete is inherently watertight and impermeable and therefore it is important to have watertight joints at the window-to-precast concrete interface to prevent water leaks. The architect should examine and modify these details as required. The contract documents should require that the same sealant contractor seal all joints in order to provide sealant continuity and avoid incompatibility, thereby providing single source responsibility.

For large projects or for special conditions where moisture protection/penetration is a concern, specifications may call for the production, shipping, and erection of a full-scale mockup at a testing lab. This mockup should include various precast concrete and window elements assembled and caulked. While a wind-driven rain test can be costly and time consuming, it can verify moisture protection details and satisfy any moisture penetration concerns or requirements. The cost of these tests must be included in the project budget. These mockups and tests can be expensive and should be specified only where there is a demonstrated need. When such tests are needed, sufficient time must be provided in the project schedule to evaluate the test results and incorporate any consequent modifications into the final design.

After the product is erected and detailed, the architect should promptly prepare a punch list

setting forth, in accurate detail, any items of the work that are not found to be in accordance with the contract documents so that proper corrective action may be taken. A meeting between the contractor, precaster, erector, and design team should then be held promptly to discuss any questions concerning what the design team requires to be done before the work can be accepted as complete. All repairs should conform to the contract documents and the architect's requirements (for matching the color and finish of the approved sample) and should be structurally sound. Timing of repairs should be coordinated with the precaster to achieve the best results considering weather conditions with allowance for sufficient repair cure time. If the repairs cannot be completed to a satisfactory level, the repairs may be rejected. The industry standard for evaluating the visual acceptability of repairs is at a 20 ft (6 m) viewing distance with the unaided eye.

When advised by the precaster that the punch list items have been completed, the GC/CM and design team should verify the acceptability of the corrections. After the precast concrete units have been accepted, subsequent responsibility and liability for the condition of the precast concrete rests with the GC/CM.

## Responsibilities of the SER

The SER has responsibility for specifying the design criteria for the design of the precast concrete elements and for describing the intended load paths. The SER should anticipate the loadings in the structural design and provide a structural system adequate to support these loads. The SER should define the type of loading to be applied to the panels and the structure, as well as provide information and applicable codes (design criteria), including wind, seismic, or blast design, when applicable.

The SER should consider the consequences of the eccentricities of the weight of the precast concrete panels when designing the supporting structure. Any special erection procedures or sequences that may affect the supporting structure should be clearly defined, prior to bidding, in the contract documents. For example, can one elevation be erected at a time (less crane movement), or must the erection be one level at a time to prevent undue stresses on the structure? Observations in the field have shown that where precast concrete panels are erected to a greater height on one side of a multistory building than on the other, the steel framing can be pulled out of alignment. Precast concrete panels can be erected at a relatively uniform rate around the perimeter of the structure, or the designer of the structural frame should determine the degree of imbalanced loading permitted. Other limitations may involve the rigidity of the structure, requiring that walls not be erected prior to completion of floors designed to carry the lateral loads.

The SER has the responsibility of reviewing the delegated precast concrete design work for compatibility with the overall structural design. This does not, however, relieve the preparer of the design work of the responsibility for doing it correctly. Interfaces between precast con-



crete components and other construction types and materials require special attention. The SER is responsible for considering these interface conditions during structural design and shop drawings review, including temporary loading conditions during erection. Regarding stability of the structure during erection, the SER's review of erection/bracing plans should be limited to its effect on the integrity of the completed structure and the impact of the temporary loading on other structural elements that are not part of the precast concrete system. In cases where the SER has performed the complete design of the lateral-load-resisting system, his or her involvement in the erection/bracing plans needs to be to a greater level of detail in order to provide adequate guidance to the erection of the precast.

The SER should determine and show on the contract documents the locations for supporting the gravity and lateral loads of the precast concrete units, including intermediate lateral (tieback) connections, if necessary. The SER's review of the erection drawings confirms that the structure is adequate, within defined deflection limitations, to resist the anticipated loads and forces from the precast concrete, and verifies that the magnitude and location of the loading locations on the structure agree with the original design intent. It is important that preliminary meeting(s) between the architect, SER, and precaster be held before structural members are ordered and fabricated so panel sizes, shapes, and basic connections and their locations can be established. For steel frame structures, the SER should determine how far in advance the final connections of the frame must be completed prior to precast concrete panel erection.

The gravity supports of precast concrete panels are generally eccentric to the centerline of the supporting steel or concrete members. The SER should design the structural members to prevent excessive deflection and rotation of the supporting structure during and after erection of the precast concrete, and should also determine the need for diagonal bracing or stiffening of supporting structural members. Supplemental framing necessary to support the precast concrete should be noted on the structural drawings. Responsibility for designing, supplying, and installing the bracing for the structure and the secondary steel should be clearly addressed in the contract documents and discussed in a prebid meeting. Typically, the steel subcontractor supplies all supplemental support, such as diagonal bracing and stiffeners based on the SER's design, and coordinates locations with the precast concrete erection drawings.

## Responsibilities of the General Contractor/Construction Manager

The responsibilities of the CM, who is engaged by the owner to manage and administer the construction, may be different from those of the GC, depending on the CM's agreement with the owner and local practice. The responsibilities of the CM, while generally similar to those of the GC, should be clearly defined in the contract documents.

The GC/CM should have the responsibility and authority of implementing the design intent of

the contract documents, which includes furnishing materials, equipment, and labor; maintaining specified quality and schedule requirements; and coordinating all trades. The GC is responsible for construction means, methods, techniques, sequences, and construction procedures. Also, the GC should initiate, maintain, and supervise all safety procedures and programs on the construction site. Site access to the structure for erection of the precast concrete elements is an important issue. The GC is responsible for providing and maintaining clear, level, well-drained unloading areas and stabilized road access around and into the structure so the hauling and erection equipment are able to operate under their own power.

The GC/CM generally has no direct design responsibility but does, however, have considerable impact on the design process through their coordination role. The GC/CM is responsible for coordinating the information necessary to allow the preparation of the precast concrete erection drawings as well as reviewing and securing approval for the shop drawings, samples, mockups, and range samples. The GC/CM receives the shop drawing submittals from the various trades and together they form the completed project design. The GC/CM is responsible for the timely transmission and resolution of requests for information. The GC/CM is normally responsible for project schedule, grid dimensions at each floor level (which includes control points, benchmarks, lines on the building, and work points for angled or curved building elevations), so all trades are working from uniform data and common reference points. Dimensional interfacing of the precast concrete with other materials and construction trades, and the maintenance of the structure's specified tolerances to ensure proper fit, are also responsibilities of the GC/CM. The GC should notify the precaster and erector when as-built conditions (dimensions) of the structural framing vary beyond the tolerances stated on the contract drawings. Dimensional tolerances between interfacing materials, such as precast concrete units and glazing, should also be considered.

The GC/CM should encourage direct communication between the precaster, the SER, and the architect. All communications should be confirmed in writing and distributed to all parties in order to avoid misunderstandings.

Typically, the GC is responsible for placing embedded items in cast-in-place concrete and coordinating steel attachments with the steel fabricator according to a layout or anchor plan supplied by the precaster or as designated on the contract documents. Typically the most economical approach is to have required connection hardware attached to steel columns or beams by the steel fabricator. This necessitates awarding the precast concrete contract simultaneously with the steel contract so that early coordination between these trades can occur. Changes to panel bearing surface and anchorage locations other than adjustments within prescribed tolerances require approval by the design team. The GC/CM should provide the precaster with as-built surveys of embedded items, anchor bolts, and other attached hardware so that misaligned or missing hardware can be identified and remedial actions undertaken by the GC/CM prior to erection of precast concrete units.

For concrete frames, footing, and piers the GC/CM should provide the erector with authoriza-

tion to begin erection after the concrete has attained sufficient strength to support the loads imposed during precast concrete erection and any interfering formwork or shoring has been removed. For steel frame structures, the GC/CM should provide the erector with the authorization to begin erection after the steel frame has been adequately detailed and stabilized, which is typically after concrete floors have been placed.

After erection of the precast concrete panels, the GC/CM should notify the architect for the inspection of the precast concrete work. Representatives of the precaster and the erector participate in this inspection tour and answer any questions posed by the architect. The GC/CM should request a final punch list from the architect so that remedial items can be finished in a timely manner to avoid delaying subsequent trades.

After the precast concrete units have been installed on the structure in conformance with plans and specifications and the installation is accepted by the architect, subsequent responsibility and liability for the protection of the precast concrete during the construction phase of the project should rest with the GC. Provisions for any construction loads that are in excess of stated design requirements that may occur after precast concrete unit installation are the responsibility of the GC.

## Responsibilities of the Precaster

Precasters will perform component and connection design of the members they produce when required by the contract documents. Precast concrete reinforcement is determined by building codes and industry standards and the design criteria defined by the contract documents.

All drawings and specifications that convey the requirements for the precast concrete scope should be provided to the precaster. Pertinent drawings might include architectural, structural, electrical, plumbing, and mechanical drawings, depending on the size and scope of the project; approved shop drawings from other trades; and site plans showing available erection access and storage areas.

For practical reasons and economy, the precaster first determines the panelization (panel sizing and joints) and then the connections. Ideally, a precaster performs value engineering early in the preliminary design phase (in a partnering relationship) to reduce construction costs, improve structural efficiency, and facilitate erection and precast concrete performance.

The precaster should request clarification of ambiguities in writing from the design team through contractual channels on special conditions not clearly defined by the design documents. Precast concrete erection and shape drawings should be submitted to the design team for approval or acceptance. This submittal is typically done through the GC. When the construction schedule demands a rapid turn-around time for review of drawing submittals, the precaster should notify the design team of their obligations to review and return

submitted drawings within the agreed upon time period to avoid costly delays in the project schedule. Review meetings for information exchange and resolution of conflicts can expedite the approval process.

The precaster prepares detailed shape and erection drawings and design calculations that are usually signed and sealed by a professional engineer registered in the state where the project is located. These drawings and calculations should show all design criteria; identify all materials; illustrate precast concrete panel interfacing with other precast concrete units, the structure, and adjacent materials; and indicate the magnitude and location of all design loads imparted to the structure by the precast concrete connections. Design modifications should be permitted only after the design team's approval of the proposed change.

The precaster designs the precast concrete panels and connection hardware for the design loads defined by the SER. The precaster is responsible for selecting, designing, and locating hardware and panel reinforcement as well as items associated with handling, storing, shipping, and erecting the precast concrete units. If necessary, this also includes an erection and bracing sequence developed in conjunction with the erector, SER, SSE, and GC to maintain the stability of the structure during the erection phase.

Additional design responsibilities for the precaster should be clearly defined in the contract documents and may occur when the design team uses Options II and III (Table 1). Option III might be used for design-build or with performance specifications.

Quality control for product manufacturing is provided by the precaster according to provisions contained in a comprehensive quality system manual developed by the precaster in addition to requirements contained in PCI MNL-117. Quality assurance is provided through the precaster's participation in the PCI Plant Certification Program. Additional inspection at the owner's expense may be required, by specification, through the owner's quality assurance agency.

## Responsibilities of the Erector

The responsibility for erection of the precast concrete units may be part of the precaster's contract, to be performed by the precaster's own crews or subcontracted to specialized erection firms, or it may be assigned separately by the GC. Fabrication and erection included in one contract is recommended by precasters because this improves coordination and provides single source responsibility.

Erectors and precasters coordinate development of efficient connections to facilitate erection for each project based on their equipment and expertise. The erector should coordinate the erection plan including the sequence of erection with the GC/CM and the precaster.

The precast concrete erector should lay out the panels based on the GC/CM's control lines and elevation data. This layout should provide panel and joint locations and elevations. This survey should identify any potential problems caused by building-frame misalignment or out

of dimensional tolerances. Any discrepancies between site conditions and the erection drawings that may cause problems during erection should be noted in writing and sent to the GC/CM for resolution prior to the start of erection. Some of these potential problems could include improper structural steel alignment or hardware installation, errors in bearing elevation or location, and obstructions caused by other trades. Erection should not proceed until these discrepancies are corrected by the GC/CM, or until the erection requirements are modified. This survey will also keep the differential variation in joint widths to a minimum and expedite precast concrete panel erection.

Installation quality assurance will be in accordance with industry standards, such as the *PCI Erector's Manual: Standards and Guidelines for the Erection of Precast Concrete Products* (MNL-127). Additional quality assurance can be provided by requiring installation by an industry-qualified or certified erector.

## Appendix

### Bid Process

Where the selection of a precaster is not negotiated or controlled by the owner or architect, but is governed by an open-bid situation, the following bid process is recommended.

**STEP 1 – Verification of architect's concepts and systems:** A review of the proposed precast concrete concepts during the early design development stage of the architectural contract documents should be arranged with at least one local precaster. This review confirms or modifies the architectural concept so that a realistic approach is presented on the architect's bid drawings.

Items to be discussed or reviewed:

- Panelization, form families, piece sizes and weights, and reveals;
- Shipping and erection issues;
- Architect's concept for structural support or connections for the precast concrete units so that the architect can communicate support requirements to the SER;
- Desired aesthetic issues relative to mixture(s) and finish(es) and the sample review process;
- The architect's intent for any interfaces with adjacent systems, such as windows, roofing, or building entrances; and
- Requirements for mockups or other special testing requirements.

**STEP 2 – The prebid conference:** This is a recommended meeting for all precasters intend-

ing to bid the project, usually held at least three weeks before the bid date. The design team presents the precast concrete concepts for the project so that competitive and responsive bids will be obtained. This will improve communication and resolve outstanding questions prior to preparation of cost estimates and bids. Items to be discussed include:

- Specifications, PCI plant certification requirements, and any special provisions;
- Design responsibilities and lines of communication;
- The architect's approved finish samples with information on the mixture proportions, where applicable;
- Prebid submittal requirements, such as proposal drawings and finish samples;
- Project schedule, shop drawing submittal requirements, and architectural review turnaround times;
- Mockups, if applicable;
- Potential problems, discrepancies, or both, found in the contract documents;
- Panelization of precast concrete units;
- How and where the project's precast concrete units will be structurally attached to the building frame;
- Interfacing with other trades;
- Responsibility for designing, providing, and installing embedded items, anchor rods, connection hardware attached to structural steel, bracing, and other structural items;
- Hardware and reinforcement finishes;
- Special erection needs (access, crane limitations, and sequence) and logistics; and
- Responsibility for caulking of precast concrete panel joints.

**STEP 3 – Post-bid scope review:** This review allows the architect and GC/CM to review the precaster's proposal and confirms the precaster's ability to satisfactorily meet the project requirements and conform to design concepts and finish requirements. This material should include:

- Proposal drawings that express the architectural precast concrete panelization and structural connection concepts;
- Finish samples;
- The history of the precaster's organization as well as confirmation of the plant's PCI quality-assurance (plant certification) program;

- A list of comparable projects, references, and financial capability;
- Key schedule items, such as mockup panels, shop drawings and design submittals, mold production, production start and durations, and erection start and durations; and
- Qualifications to the bid.

If the project allows for a negotiated precast concrete contract, and the precaster is brought on board during the initial stages of development, prebid and bid submittal information can be minimized.

**STEP 4 – Preconstruction coordination.** A preconstruction conference should be held at the jobsite after award of the precast concrete and erection contracts. The GC/CM should conduct frequent jobsite meetings to coordinate precast concrete design and erection with the work of other trades and general building construction.

The coordination meetings should consider all details of loading, delivery sequences and schedules, types of transportation, routes of ingress and egress for delivery trucks and erection cranes, handling techniques and devices, safety requirements, connections, erection methods and sequences, the effects of temporary bracing on other trades, and on-site storage and protection. Questions regarding site access, street use, sidewalk permits, oversized loads, lighting, or unusual working hours should be addressed at this time.

# Ascent 2013 – Design Factors Affecting Aesthetics of Architectural Precast Concrete

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## Instructions

**Review the learning objectives below.**

**Read** the AIA Learning Units article. Note: The complete article is available at [www.pci.org/elearning](http://www.pci.org/elearning)

**Complete the online test.** You will need to answer at least 80% of the questions correctly to receive the 1.0 HSW Learning Units associated with this educational program.

## Learning Objectives:

1. Explain the finish options of precast concrete.
2. Describe the methods used to achieve color, form and texture for precast concrete finishes.
3. Explain how clay products and natural stones can be veneered to precast concrete to speed.
4. Describe what composite casting is, the advantages and when best to use it.

Questions: contact Education Dept. - Alex Morales, (312) 786-0300 Email [amorales@pci.org](mailto:amorales@pci.org)