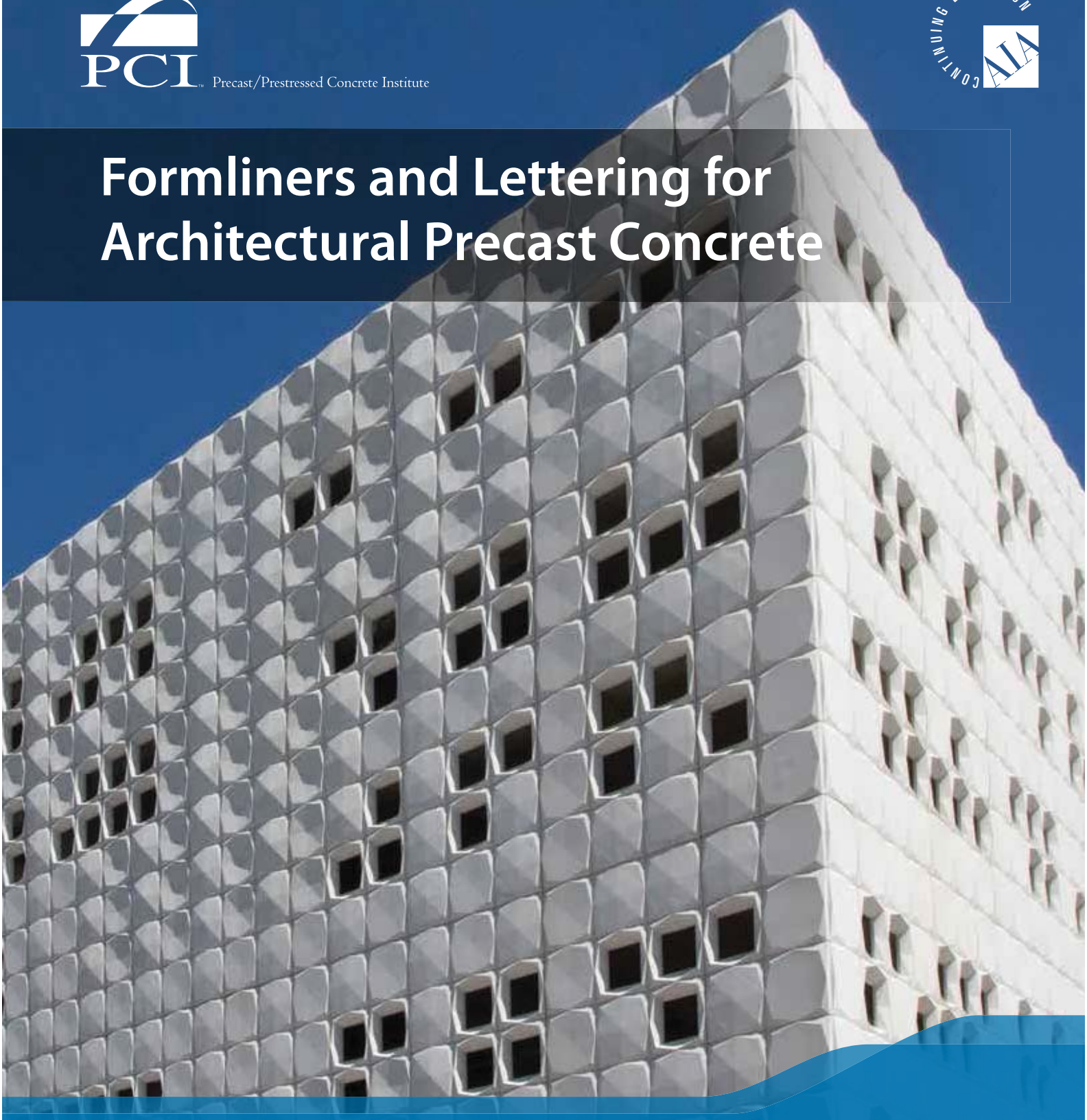
PCI Precast/Prestressed Concrete Institute

AIA CONTINUING EDUCATION

Formliners and Lettering for Architectural Precast Concrete



PCI designer's notebook

FORMLINERS AND LETTERING FOR ARCHITECTURAL PRECAST CONCRETE

Apart from its shape, it is to a large extent the façade of a building that dictates its overall impression. It is the characterizing face of the building—sometimes reserved, sometimes highly detailed and dominant. But a building envelope's materials are more than a visual application. Aesthetics, function, and cost play a role in achieving a successful project. Architectural precast concrete not only offers design freedom of architectural expression with visually interesting shapes that are functional in application, it also contributes to durability, sustainability, energy efficiency, and improved occupant comfort and safety. At the same time, the initial plasticity of concrete makes it responsive to the designer's creativity.

Concrete's plasticity offers the opportunity for innovation and individual character in the surface textures, patterns, and shapes, which can be achieved by casting against the various types of formliners to enliven the façade surface and produce a dramatic, attention-getting aesthetic statement. These formliners may be incorporated in or attached to the surface of a mold. A large pattern offers ever-changing details due to the subtle interplay of light and shadow; a fine texture offers a muted appearance that is subtle but not drab while smooth surfaces bring out the elegance and richness of simplicity. Formliner textured surfaces also mask minor imperfections that would otherwise be obvious in a smooth as-cast surface, yielding a more uniform appearance.

New techniques and technologies provide a wide array of design possibilities ranging from traditional building patterns such as masonry, wood board markings, and stone textures, flat, geometric, rhythmic, fractured fins and fluted textures, sandblasted or bushhammered looks, as well as custom graphics including highly detailed three-dimensional graphics at a reasonable cost. The options with combination finishes, involving one or more basic finishing methods together with formliners, are almost infinite. Architects are now able to push the envelope in their façade designs.

There are typically three different types of custom graphics that can be achieved with formliners, either produced by liner manufacturers or precasters:

1. A two-dimensional pattern milled into or attached to a mold. Graphics could be letters, dates, and simple flat-planar designs.
2. Multiple planes to produce a graphic that may have different types of textures such as abrasive blast, bushhammered, or fractured fins.
3. Three-dimensional, photo-realistic graphics achieved through computer numerical control (CNC) milling of the formliner (photo-engraved) or use of a special membrane with embedded retarder where the retarded surface is exposed (photographic).

An important consideration is selecting the texture and/or type of formliner best suited to the project. If there are large wall expanses, a texture like fractured fin with greater depth may give a more noticeable appearance with deeper shadowing. Shallow flutes, bushhammered, or subtle textures are often better for relatively small areas. Concrete can be produced with vertical ribs or striations in a range of sizes to suit a particular structure and the distance from which it will most often be seen. Ribbed or fluted panels demand considerable attention to detailing as panel sizes and distances between openings must be a multiple of the rib spacing. Panel joints should normally be in the bottom of a groove or valley.

A wide range of factors impact the cost of a formliner, including material used, detail of the design, changes made after the original design, size, and the number of reuses actually obtained. For instance, increasing a shallow recess to several inches in depth can increase costs significantly due to the amount of material needed to create that depth as well as require overall thicker product since the structural capacity of the panel is determined by its thinnest section. Large liners also become more expensive as they grow in size due to shipping and handling costs—but the larger size may reduce the number of molds needed, reducing costs. Liner size may be restricted by the liner suppliers master model size as well. If the liner supplier has to produce a new, larger master model, costs could significantly increase.

The following rules should be observed when using formliners:

- Limit depth of design to ½ to 1 in. (13 to 25 mm).
- In most cases, maintain a 1:8 draft on all indentation sides to prevent chipping and spalling during stripping of the panel from the mold.
- Keep all edges and corners rounded or chamfered.
- Relief may be more than 1 in. (25 mm) if the depressed area is sufficiently wide.

Liner size and characteristics may require that an architectural feature in the form of a demarcation groove, recess, rib, or plain area be detailed to hide joints between liners, or limit usage to within the available width of the liner, or the liner joints should be designed at form edges.

If the concrete is to be left smooth as-cast (that is, without further treatment), its appearance will be determined by the surface characteristics of the liner material as well as by the chosen pattern or texture. Variations in the absorbency of the form surface will tend to produce corresponding variations in the color of the concrete, a dark color being associated with water loss.

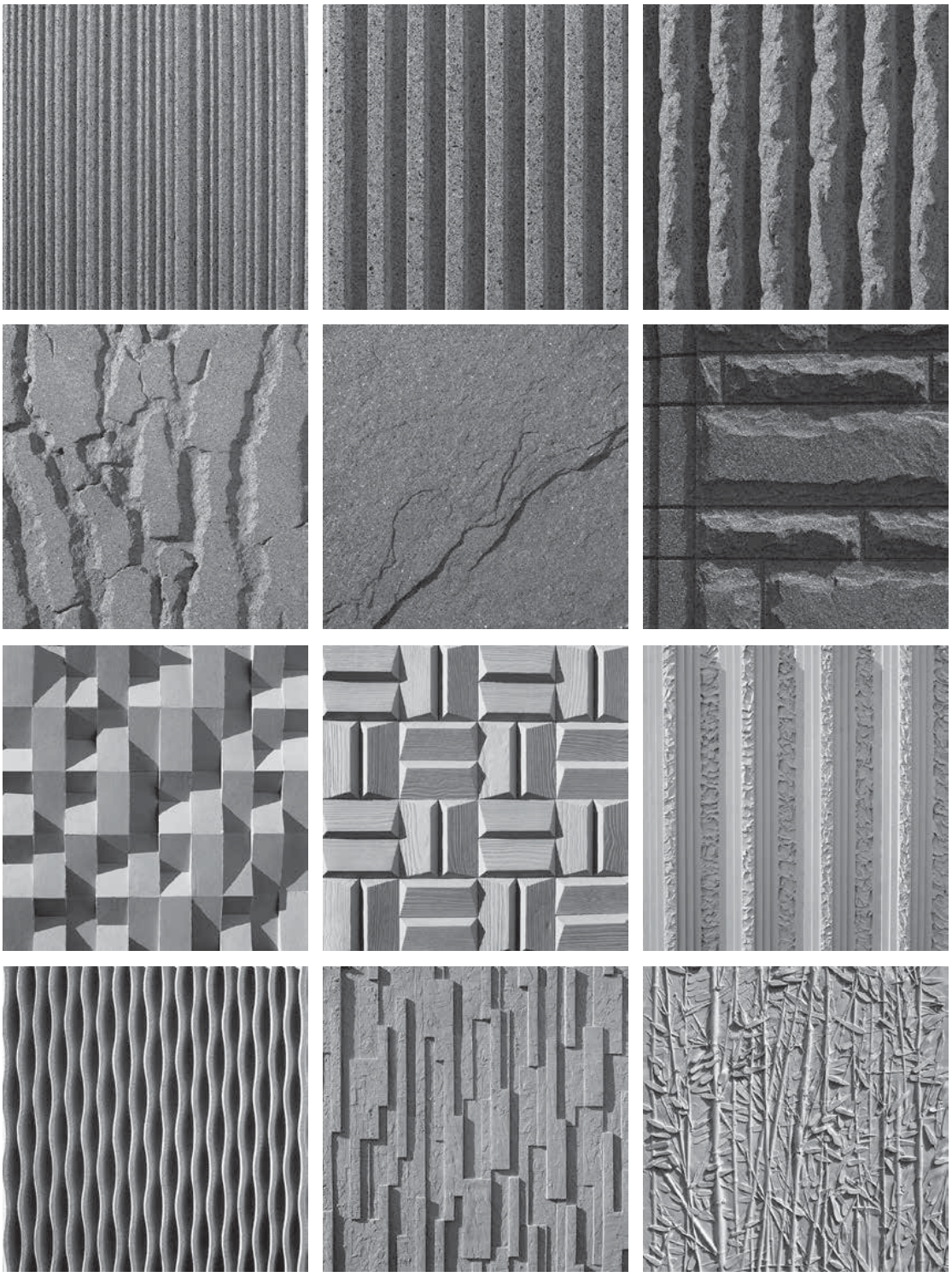


Figure 1 Some of the countless available formliner patterns.

Figure 2 Rock-faced units on Sanford Children's Hospital, Sioux Falls, S. Dak.

If preformed or stock formliners are selected, it is good practice to describe the pattern and to include a reference to the pattern and its manufacturer specification. The formliner, or the effect or texture may be specified in the contract documents. **Fig. 1** shows some of the countless available formliner patterns from liner manufacturers.

To avoid a repetitious panelized appearance to what is planned as a natural, flowing façade, liners can be rotated 90 to 180 degrees or configured to minimize the appearance of repetition so that the surfaces look entirely different.

A significant challenge was to make the castle theme architecture of the Sanford Children's Hospital, Sioux Falls, S.Dak., while maintaining budget. To do so, the architect found an economical formliner and a method was developed of repetitive use while maintaining the proper articulation. The large base "chiseled stone" was accomplished using individual 1-ft 10-in. x 4-ft 2-in. (0.56 m x 1.27 m) rock -faced units with 1 ½-in. (38 mm) relief, **Fig. 2**. These units were revised and rotated to keep the panel uniqueness while maintaining liner efficiency.

Figure 3 Chiseled limestone base for George Washington Auto Park, Winchester, Va.

The seven tier parking structure, **Fig. 3**, is located within a historical district where limestone and brick masonry are prevalent. The structure's chiseled grey limestone base ascends two tiers. Custom formliners were rotated to provide variations more characteristic of limestone. A deep relief was used in the joints to provide shadows that break up the uniformity within the precast.

Figure 4 Some of the available wood textures.

Many types of wood textures such as weathered wood boards, split cedar shakes, and hand hewn woods can be emulated with formliners, **Fig. 4**. Sealed sandblasted wood, textured plywood, and rough-sawn lumber are useful in creating rugged textures. (Resultant surface texture may also be obtained by use of other liners reproducing this finish.) Rough-sawn lumber is used for board-surface textured finishes where concrete color variations and rough edges are acceptable.

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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.

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:

This article provides an overview of the usage of formliners to add to the aesthetic interest of precast concrete surfaces. Discussed are the recent developments of photo-engraved and photographic concrete. The article also addresses the use of lettering to identify the activity taking place in the structure.

1. Explain the formliner options for precast concrete surfaces.
2. Discuss the applications of computer numerical control (CNC) for the production of custom designed formliners.
3. Explain the process for the application of photographic concrete.
4. Describe the process for the use of lettering on precast concrete.

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