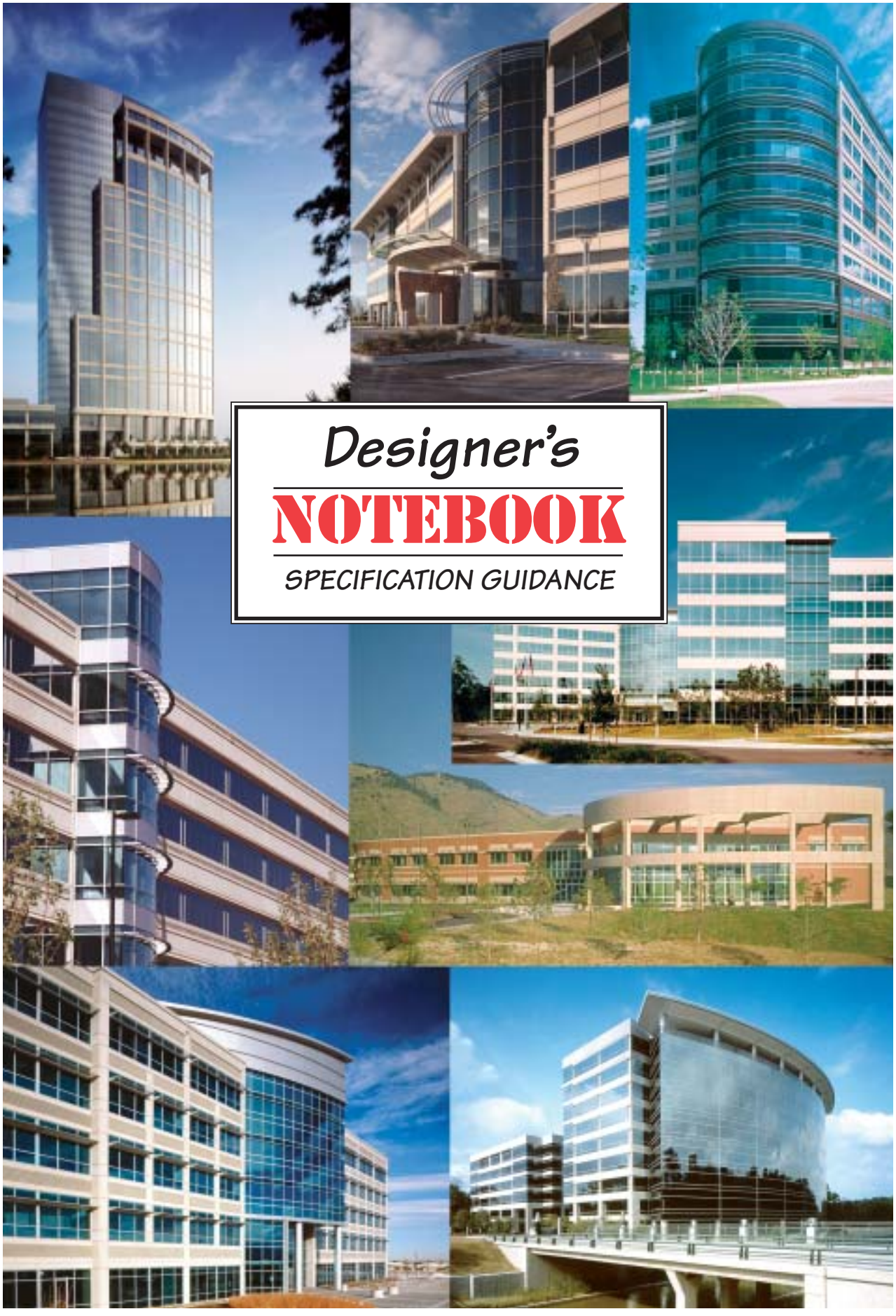

Designer's NOTEBOOK

SPECIFICATION GUIDANCE

Part II Guide Specification for Architectural Precast Concrete Panels

PCI's Architectural Precast Concrete Services Committee explains key considerations in specifying architectural precast panels

Performance Specifications

Performance specifications define the work by the results desired. For example, architectural precast concrete panel specifications will establish: (1) drawings that govern the design and arrange the various wall components; (2) materials and finishes; (3) the loads and forces the wall panels are required to support; and (4) insulating and permeability requirements. In other words, they cover the aesthetic, functional and structural requirements and define all limiting factors.

Performance specifications can achieve good results as long as the architect identifies the purpose to be served and includes appropriate safeguards, such as pre-qualification of precasters, pre-bid approval of materials and samples, careful review of shop drawings and architect's approval of initial production units.

Primary Advantage

Performance specifications' primary advantage is that they combine economy and optimum quality by using established tooling and production techniques. Conventional specifications often resort to stringent requirements to protect the architect and the client. As a result, they do not always produce the best price within the desired or acceptable quality range.

Performance specifications can create additional work for the architect at the design stage, because the end result must be clearly defined and different proposals must be assessed. The accepted proposals will eventually become the standards for manufacturing. However, this additional work in the early stages is generally offset by time saved later in detailing performed by the architect's office.

Performance specifications should define the scope (statement of needs) and quality of the precast concrete at an early stage. With performance specifications, the manufacturer is responsible for selecting means and methods to achieve a satisfactory result. When a project contains both design and performance specifications, specific areas must be analyzed to determine the degree of discretion left to the manufacturer.

Five Key Criteria

Properly prepared performance specifications should conform to the following criteria:

1. They should clearly state all limiting factors, such as minimum or maximum thickness, depth and weight. Acceptable limits for requirements not detailed should be clearly provided. These limits may cover insulation (thermal and acoustical), interaction with other materials, services and appearance.
2. They should be written so that the scope of each subcontract is clearly defined. All subcontracts must be properly related to each other so that they combine to produce an integrated project.

3. If a method other than simultaneous competitive bidding through a general contractor is contemplated, the scope and the nature of the precast concrete work in relation to other trades should be carefully weighed in the final assessment of the precast concrete solution.
4. The architect should request samples, design and detail submissions from prospective bidders and make pre-bid approval of such submissions a prerequisite for bidding.
5. To the degree that such requests for pre-bid approvals form a part of the specifications, the architect should adhere to the following requirements:
   a. Sufficient time must be allowed for the bidder to submit samples or information for approval by the architect. Approval should be conveyed to the manufacturer in writing with sufficient time to allow completion of estimate and submittal of bid.
   b. Any proprietary pre-bid submittal should be treated in confidence and the individual producer's original solutions or techniques protected both before and after bidding.

Performance specifications offer a good alternative for many projects. They may require more work in the design stage for the architect, but that work can result in the ability to take full advantage of the capabilities and expertise of the rest of the construction team.

PCI's Color & Texture Guide is available for free at www.pci.org. The online guide illustrates the world of possibilities of architectural precast options in color and texture. Visit PCI's home page, and click on About Precast > Architectural > Color & Texture Selection Guide.

Guide Specification In Development

A complete architectural precast Guide Specification is in development jointly by PCI, Gensler and the American Institute of Architects (AIA), Master Systems publishers of MASTERSPEC®.

Match Architect's Samples: Tips for Specifying Texture

Timothy Taylor, director of specifications with Gensler, shares his perspective on writing specifications for architectural precast concrete.

To many, the greatest challenge after determining a precast mix design is surface-texture specification. Surface textures are used to achieve shadows and degrees of color uniformity. "As a minimum, we typically use light sandblasting to cut the paste off the fines to get some shadow and remove any splotchiness in the color," according to Norman Hoover of Gensler's Houston office.

The Anadarko Tower located in The Woodlands, Texas, was clad with light and medium sandblast textured precast panels composed of a single face mix design. Some of the panels were supplemented with thermal finished Luna Pearl granite insets. The mix was composed of 100 percent white Portland cement, coarse aggregates (Knippa Grade 4 and Delta Type 'D'), fine aggregates (Black Beauty #2 sand and TCS ASTM sand), and pigment (DCS 836). Photo: courtesy of Gensler.

What can complicate texture specification are the means, methods and even terminology that vary from precast plant to precast plant. Many plants have developed specific techniques supported by skilled workers using specialized tools. At Discovery Square (ASCENT Summer 2002 Designer's Notebook), a recent project designed and completed by Gensler's Washington, D.C., office, David Epstein specified prefabricated polyethylene formliners to obtain horizontal ribbed shadow lines, as he knew that the precaster providing his pre-construction precast samples preferred their use. Another precaster, who was awarded the work for the project, used his in-plant millwork shop to shape ribbing from wood to match the specified formliner profile.

Acid-washed finishes, popular because of their resemblance to a sugar-cube textured limestone, often are substituted for light sandblasted texturing because the successful precaster can provide the building owner an attractive schedule and price but without the specified finish, which he does not have the equipment and personnel to provide.

Wide Range of Textures

The most commonly specified textures for precast include smooth, retarded and water-washed, form-lined, sand- or abrasive-blast, acid-etched or acid-washed, and tooled.

Smooth texture, as the term implies, is an as-cast finish. This texture is a direct result of the quality of the formwork surface. It is the least aesthetically pleasing but the most economical of the surface textures, especially if the surface is to be field painted. Form defects and color non-uniformities are noticeable with this finish texture, air voids are normal, and surface crazing should be expected.

Retarded and water-washed textures are achieved by using nonabrasive means to fully expose the natural color and brightness of coarse aggregate. Chemical retarders work by delaying the hardening of the cement surface paste over selected time periods and to selected depths, which is followed by water washing and brushing.

Water-washed textures simply use high-pressure water and brushes to remove surface paste prior to the hardening of the paste. Water washing, unlike retarded finishing, has a propensity for dislodging the coarse aggregate, which may require reseeding for a uniform surface texture. Retarded and water-washed textures can be applied to both formed and unformed surfaces to produce light to heavy aggregate exposure. They are easily repairable, and the form surface quality is not critical. The heavier the aggregate exposure, the more these textures will cost, making exposure-depth specification paramount. Water-washed and water based retarded texturing may be more environmentally friendly than solvent based retarded finishes and should be explored as an alternative to solvent based chemical retarders.

Form Liners Expand Options

Form liners and reveals can be used for an infinite variety of surface texturing and patterns. Frequently, they are specified in conjunction with other textured finishes. However, according to Hoover, "It is not unusual to use form reveals to create a shadow line rather than a field of texture or pattern. They can be quite useful as transitions between changes of finish texture or aggregate color. They also are convenient places to hide sealant joints between panels."

The single concrete mix shown here has three different finishes. From left to right, they are acid etch, sandblast and retarded. This multiple-finish technique offers an economical, yet effective, way to heighten aesthetic interest.

Liners can be fabricated from almost any material, with the most popular options including plastic, wood, extruded-polystyrene foam, and combinations of plaster and latex molding materials. Specification of form-liner attachment using tapes, sealants or adhesives is critical to avoid the often undesirable telegraphing of form-liner fasteners, countersunk fastener heads and edge or side laps imparted to the cast surface.

If preformed plastic formliners are selected, it is good specification practice to describe the pattern and to include a reference to the pattern and its manufacturer. Similarly, if smooth, textured, or patterned form-liner surface treatments are required, they should be described in the specification. Common examples include woodgrained plywood and board forms, brick and rock faced.

Detail of a glass to precast plane transition at the Waterway Plaza, The Woodlands, Texas. Note how the hue of the mix design complements the window frame coating. The precast panels were fabricated from a single mix containing white Portland cement, coarse aggregate (Texas Pink), and fine aggregates (Black Star, Big Sandy Sand, and White Sand). After casting, the panels they received light or medium sandblast texturing. Photo: courtesy of Gensler.

Hoover advises that, "There are also practical limitations to depth and profile that should be considered for reveals having excessive depth." Excessively deep reveals may increase shadow lines but will necessitate greater panel thickness to overcome bowing and other undesirable effects of thinner panel section.

Blast Finishes

Because they yield such a broad variety of appearance with reasonable cost, blast finishes are the most commonly specified of precast textures. There are three generally recognized degrees of sand- or abrasive-blast finish. The least aggressive is a light blast, which is commonly specified where a sugar-cube limestone surface texture is desired. Light blasting abrades the precast surface to remove surface cement/sand paste enough to just begin to reveal the coarse aggregate and can provide greater color uniformity than as-cast texturing, without exposing the coarse aggregate.

Medium blasting removes the paste to the extent that approximately half of the exposed surface area of the panel is coarse aggregate. Heavy blasting removes essentially all of the paste from the surface area of the panel, revealing the coarse aggregate in all of its glory. Like retarded and water-washed textures, the heavier the aggregate exposure, the more these textures will cost, making exposure depth specification paramount. The extent to which aggregates are exposed or "revealed" is largely determined by their size. Reveals should not be greater than one-third the average diameter of the coarse aggregate particles or one-half the diameter of the smallest sized coarse aggregate.

Blasting operations tend to brighten aggregates by fracturing their exposed faces. This causes sunlight to be reflected, and the aggregate manifests frosted, muted hues. Maintaining continuity of plant personnel, equipment and time interval from casting through finishing is essential in achieving consistent blast-surface texturing and should be specified. Blast finishes are relatively easy to patch.

Blast Alternatives

Acid-etched or acid-washed surface textures often are specified as an alternative to light blasting. Light etching removes surface cement/sand paste and imparts a fine, sandy texture similar to a sugar-cube limestone surface texture without exposing coarse aggregate. Medium etching will remove the paste enough to just begin to reveal the coarse aggregate. When specifying acid etching, wetting the surface before and after the application of the acid is essential to avoid color uniformity problems and the potential for in-service efflorescence. Light acid-etched textures are more difficult to patch than light-blast textures.

As with form liners, hand and power tools can be used to create an infinite variety of surface textures to precast. As if to confuse designers and specifiers, the precast industry simply names the use of any tool for this purpose as bushhammering. Specifications for uniformity or non-uniformity of tooled finishes are extremely difficult to write and assistance should be sought from a precaster providing the tooled finish being specified.

Examples of light, medium and heavy sandblast textures.

Examples of light, medium and heavy acid-washed textures.

Development of sample panels is essential. At the least, limitations for finishing should provide that no changes in equipment, materials, procedure or personnel are permitted. Since many tooling processes can impart large localized stresses to precast panels, additional criteria may need to be provided. Excessive localized stress can cause damage, such as through-panel cracking, exposure of panel reinforcements, and corner loss. Criteria that will limit such damage may include increased panel thickness, allowing concrete to attain 75 percent or higher 28-day strengths, increased concrete cover and holding back texturing a predetermined distance from corners.

Specifying Guidebooks

Specifying color and texture in precast can be a difficult, laborious and seemingly impossible task. Fortunately, there are resources available to the specifier that can make this task a little less onerous when the specifier does not have a sample to match. One is the PCI's Architectural Precast Concrete Color and Texture Selection Guide. The guide was specifically developed as a jumping-off point for the selection of color and texture. It contains several hundred images of colors and textures, and their associated mix materials, which can be achieved with architectural precast concrete.

PCI's Color & Texture Guide is available for free at www.pci.org. The online guide illustrates the world of possibilities of architectural precast options in color and texture. Visit PCI's home page, and click on About Precast > Architectural > Color & Texture Selection Guide.

Another resource that is useful in the development of specification text describing precast finishing is the PCI's Collection of Ideas on the Production of Architectural Precast Concrete, which is available for sale from PCI.

The availability, quantity, performance, cost and production considerations of each ingredient and finish of architectural precast concrete can have a large impact on a project's schedule and budget. Therefore, they should be determined and specified for each specific project before the project specifications are released. The time and expense required to develop samples and select mix colors and textures can be considerable and should not be underestimated by the design team.

The next part in this series will present considerations for clay-faced and stone-veneered finishes.

—Timothy Taylor, Director of Specifications, Gensler, Washington, D.C.

To be continued in the Spring 2003 issue.