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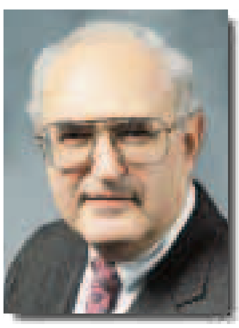
Aesthetics of Architectural Precast Concrete

Design Factors Influencing the Aesthetics of Architectural Precast Concrete



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Aesthetics is playing an increasingly important role in the design of building façades. In North America and Europe the concept that aesthetics (form) must follow function is well established. This article demonstrates the enormous potential of architectural precast concrete applications. The abundance of possibilities gives rise to a multitude of different forms, colors, surface finishes, and architectural designs. The era is long over when concrete was known simply as a utilitarian material. Technological innovations in concrete composition, molds, and finishes have increased the quality of this material, enabling it to compete with the most exclusive façade claddings. It is the architect's responsibility to exploit these varied possibilities. The important aspects of sample selection for color and texture as well as the use of range samples to set production standards for color and texture, are illustrated. The myth that precasting leads to little flexibility in façade design no longer holds true. On the contrary, because of the inherent properties and varieties in shape, architectural precast concrete is at the forefront of architecture as one of the most flexible contemporary solutions for structural façades.

During the last decade, aesthetics has gained considerable importance in the design of overall structures and precast concrete components. Several factors have influenced the design of buildings and façades; for example, greater design freedom, complex surfaces, use of refined and more costly materials, and demands on quality and durability.

Aesthetics is a relative concept, especially within the context of worldwide building design. In Europe, for example, there are considerable differences in architectural aesthetics between the colder northern countries and the warmer southern countries. The former generally focus on plainness in architecture, in line with Modernism, whereas the latter on more elaborate styles.[1]

Today, people generally dislike seeing monotonous buildings; instead, they much prefer to see attractive and human scale architecture. As a result, design is increasingly governed by aesthetics. Key words for the trends in precast architectural façade design are human scale, aesthetics, natural or traditional linked materials, and flexibility. However, what is most striking in the concept of new buildings – compared to 20 years ago – is the much greater freedom in the design of the façade.

Volumes, surfaces, lines, and differences in level are becoming increasingly important. Box-shaped buildings composed of nearly all the same basic elements have been abandoned. Instead, the design now focuses on the "total concept" of the façade.

Arguments about the beauty of concrete by the public and client often obscure the quality of precast concrete architecture. Consequently, architects are concerned over public and client acceptance. Frequently though, the public waits for the critics to tell them what they like.

Architecture focuses on space, structure and proportion. In this respect, precast concrete is ideal because it provides the freedom and flexibility of shaping concrete into structure and architecture. In the classical periods of stone building – the Greek, the Romanesque, the Gothic – distinctions between structure, ornament, and architecture simply had no relevance. They were all carved out of the same external-internal continuum of architectural mass and space. Yet, the three dimensions of structure are the essential domain of architecture.

One of the major advantages of concrete is its moldability. Because of this feature, concrete has become the architect's favorite material. Concrete is really like the sculptor's clay in an architect's hands. It gives the architect greater freedom in the design of façades than do most other materials. The only limits are imagination and creativity (see Fig. 1).

Architectural mass and space are defined first of all by proportions – then fleshed in by matter and brought to life by light and shadow. An anonymous quote states this concept well. "Beauty Itself Doth of Itself Persuade the Eyes of Man Without an Orator."

Fig. 1. Baha'i Temple, Wilmette, Illinois, designed by Canadian architect Louis Bourgeois. This structure, started in 1920 with final completion in 1953, is one of the most beautiful and delicately conceived buildings in the United States.

Architectural design determines the texture of a completed building. The distance between the viewer and the finished building determines its appearance. The building's texture is developed by the architect's successful use of light, shadow, and color in the design.

With respect to the form of the concrete façade elements, there is an increasing trend towards profiled elements with considerable surface ornamentation. Stone elements, which in the ancient Greek and Roman époque were carved by hand tools, can now be made again in architectural concrete because of modern manufacturing processes and advanced concrete technology.

SAMPLES – SELECTION OF COLORS AND TEXTURE

In dealing with concrete, the architect and owner need to be prepared for variations and the slight imperfections inherent to the medium. Architects seem ready to accept a significant amount of variation in natural stone, but forget that concrete is constituted of nearly the same material. Concrete is not transformed because it is cast. Moreover, precast concrete should be viewed at a minimal distance of 20 ft (6.10 m), not examined with a magnifying glass at 10 in. (254 mm).

Initial color and texture selection is usually made from 12 x 12 in. (305 x 305 mm) samples or by using the PCI Color and Texture Selection Guide.[2] Color selection should be made under lighting conditions similar to those

Fig. 2. Display of small samples.

under which the precast concrete will be used, such as the strong sunlight and shadows of natural daylight.

If small samples are used to select the aggregate color, the architect should be aware that the general appearance of large areas of a building wall may vary from the samples (see Fig. 2). For non-planar, curved, or other complex shapes, a flat-cast sample may not represent the anticipated appearance of the final product. Sample shapes should be selected that will offer a reasonable comparison to the precast units represented (see Fig. 3).

Fig. 3. Display of large scale sample.

The production of uniform, blemish-free samples, which demonstrate the abilities of a single master craftsman, will be completely misleading and could cause problems when the production personnel, using actual manufacturing facilities, have to match "the sample." Samples should be made as nearly as possible in the same manner intended for the actual units.

Small 12 in. (305 mm) square samples do not generally reflect the relationship between materials, finishes, shapes, casting techniques, mold types, thickness of concrete section, orientation of exposed surfaces during production, and consolidation procedures (see Fig. 4).

Aesthetic (visual) mockups, usually 4 or 6 ft (1.22 or 1.83 m) square, should be produced using standard production equipment and techniques. Some important variables that should be controlled as close to actual cast conditions include: retarder coverage rate and method of application, mix design and slump, admixtures, heat of plastic and cured concrete, age, vibration, piece thickness, and method of cleaning. This is especially important with light etches which are affected by changing conditions.[3]

Special details such as reveal patterns and intersections, corner joinery, drip sections, patterns, color and texture, and other visual panel characteristics should be demonstrated in large production samples for approval. Changes in aggregate orientation, color tone, texture, and uniformity of returns, can easily be noted on aesthetic (visual) mockup panels.

The objective of the visual mockup sample can also demonstrate the more detailed conditions that may be encountered in the project (recesses, reveals, outside/inside corners, multiple finishes, textures and veneers). Even this sample may not be fully representative of the exact finishes that can be reasonably achieved during mass production.

Samples should be supplied for each of the different finishes for a project and all submitted samples should be clearly identified. When approved, these samples form the basis of judgment for the purpose of accepting the appearance of finishes. These samples should establish the range of acceptability with respect to color and texture variations, surface defects, and overall appearance. Samples should be viewed at a distance consistent with their viewing distance on the structure but not less than 20 ft (6.10 m).

At least three range samples of a size sufficient to demonstrate actual planned production conditions may be used to establish a range of acceptability with respect to: color and texture variations, uniformity of returns, frequency, size and uniformity of air voids distribution, surface blemishes, and overall appearance (see Fig. 5). The acceptability of repair techniques for chips, spalls or other surface blemishes should also be established on these samples.

Fig. 4. Small samples should be used only for initial color and texture selection.

The face of each sample should contain at least two areas of approved size and shape, which have been chipped out and then patched and repaired. The color, texture, and appearance of patched areas should match that of the adjacent surface.

The samples should be stored outdoors and positioned to allow a comparison with production units. They should be stored adjacent to each other to allow proper lighting (sun and shade) for daily comparisons of the production units for finish and exposure.

Where mockup units are not used, the precaster should request the architect/engineer and/or owner to inspect and approve (sign and date) initial production units. Larger production samples will remove uncertainties in the minds of both the architect/engineer and owner (see Fig. 6).

To avoid possible later controversies, this mutual approval should precede a release for production. The architect should realize, however, that delays in visiting plants for such ap-

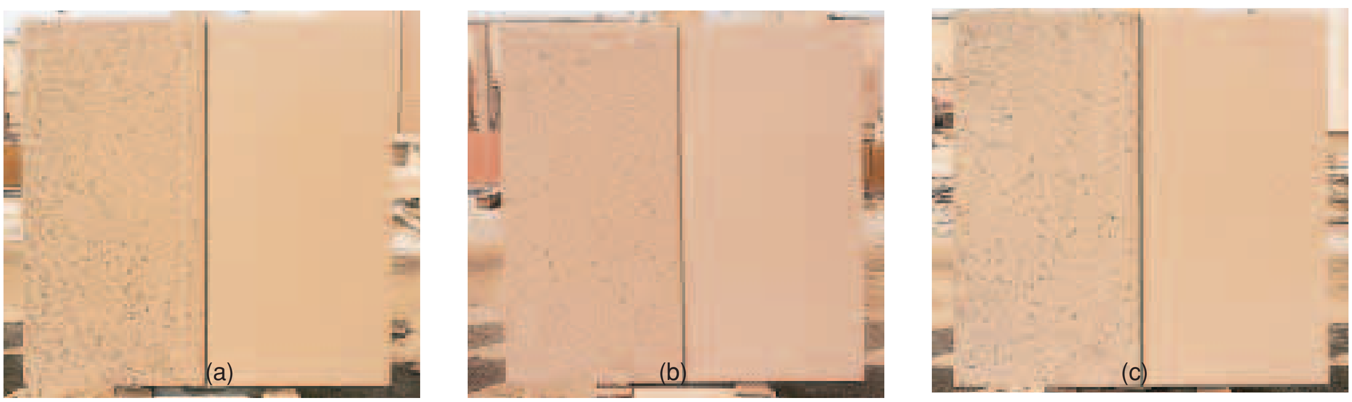

Fig. 5. Use of 4 ft (1.22 m) samples to establish acceptable range of color and texture. Concrete made with 3/8 in. (9.53 mm) aggregate with retarded (left side) and acid etched (right side) finishes.

Fig. 6.
This production panel was created after examining the samples in Fig. 5.

provals may upset normal plant operations and the job schedule. The contract documents need to clearly state the time period in which production units or the mockup structure should be kept in the plant or jobsite for comparison purposes.

It is recommended that the contract documents permit the approved full-sized units to be used in the job installation in the late stages of construction. The units should remain identifiable even on the structure, until final acceptance of the project. The panels should be erected adjacent to each other on the building to allow continued comparison, if necessary.

Uniformity of color and intensity of shading are generally a matter of subjective individual judgment. Therefore, it is difficult to establish definitive rules for product acceptability on the basis of appearance. At a minimum, finished face surface should have no obvious imperfections other than minimal color and texture variations from the approved samples or evidence of repairs when viewed in good typical daylight illumination with the unaided naked eye at a viewing distance of 20 ft (6.10 m). Appearance should not be evaluated when light is illuminating the surface from an extreme angle because this accentuates minor surface irregularities.

The objectives of the precast industry

Fig. 7. TransAmerica Building, San Francisco, California. Architect: Johnson Fain Partners, Los Angeles, California.

Fig. 8. Merrill Lynch Corporate Campus, Englewood, Colorado. Architect: Thompson, Ventulett, Stainback & Associates, Atlanta, Georgia.

Fig. 9. Close-up detail showing simulated sandstone and limestone.

are to follow the design trends and to inform the clients and designers about the possibilities of precast concrete. The following discussion will show the versatility of architectural precast in meeting the architect's aesthetic needs. Also discussed is how almost any architectural style imaginable can be expressed with architectural precast concrete.

For more details of these structures, a list of references is provided at the end of the article.

APPLICATIONS OF ARCHITECTURAL PRECAST CONCRETE

Similar to a magazine cover, a building's exterior creates a visitor's strongest impression and a company's most enduring image. Take the familiar landmark, the TransAmerica Building in San Francisco, California. Clad entirely in architectural precast concrete (see Fig. 7), the building is 48 stories tall, and capped by a 212 ft (64.6 m) spire, for a total height of 853 ft (260 m). Floor-height, double-window units, weighing $3^1/_2$ tons (3.18 t) each, make up half of the total precast pieces used, with two variations for all corner units. It is just one of thousands of buildings with unique, distinctive facades that has been created with architectural precast concrete.

Fig. 8 shows the corporate campus for Merrill Lynch in Englewood, Colorado,

Fig. 10. 2777 East Camelback Office Building, Phoenix, Arizona.
Architect: Daniel, Mann, Johnson & Mendenhall, Phoenix, Arizona.

Fig. 11.
Close-up of terminating spandrel fin.

which is designed to house one million sq ft (93,000 m^2) of office space in five buildings. The first two buildings of this campus are complete. The site is a 70 acre (28.3 ha) tract on the highest ground for several miles in every direction, with a commanding view of the front range of the Rocky Mountains. Because of this high visibility, it became an important architectural goal that the campus create a bold, striking, sophisticated, corporate image, visible from a long distance.

The simple shape and massing was developed to reinforce the long horizontal planes stepping up the hillside. However, these simple rectangular forms also maximize space planning efficiency and accommodate the load-bearing precast concrete structural system which is prevalent in the region.

The building's exterior was developed to address both the micro and macro scales. The long, low, dark-gray roof was designed to resemble a silhouette against the light-blue sky. Along with the roof, the dark-gray top floor windows and overhanging steel trellis sunshade complete this horizontal cap to the building. The large (30 ft wide x 40 ft high) (9.14 x 12.2 m) red portals were also devised to be of grand enough scale to be seen from the distant interstate highway.

As one approaches the buildings, interesting detail abounds (see Fig. 9). The large red portals are architectural

Fig. 12. Shriners Hospital Parking Structure, Sacramento, California. Architect: Odell Associates, Inc., Charlotte, North Carolina.

Fig. 13. Combination of finishes adds interest to structure.

precast concrete designed to replicate native Colorado Red Sandstone. Within these large red portals, limestone colored architectural precast concrete tracery accentuates window openings. This accent establishes a more delicate handmade scale to the buildings. The overhanging trellis sunshade protects windows from the harsh Colorado sunshine while adding fine detail and visual interest to the form.

Building a 107,000 sq ft (9940 m^2) speculative office building within the historic Biltmore district of Phoenix, Arizona, required special attention to aesthetics to match the surrounding neighborhood (see Fig. 10). The integral aesthetics consisted of the sleek long lines of the spandrels and a limited palette of materials. Two parts of the spandrels were designed; spans between the columns and the terminating fin. The fin is a key element because it visually terminates the building and integrates it with the other building components (see Fig. 11). The precast concrete serves as a subtle, delicate detail that complements the design as a whole.

The parking structure for the Shriners Hospital in Sacramento, California, forms the gateway to the medical center complex (see Fig. 12).[4] The panels' integral horizontal band of red granite wraps the entire building.

Fig. 14. Main entrance to Aurora Colorado Municipal Justice Center, Aurora, Colorado.
Architect: Skidmore, Owings & Merrill, Washington, D.C.

Fig. 15.
Boldly detailed loadbearing window-wall units.

Green terra cotta medallions within the granite band generate further interest. Two different finishes were created by alternating the sandblasting depths, resulting in contrasting textures, with reveals added between and around insets and bands (see Fig. 13). The creative result is a beautiful complementary parking structure that blends well with its environment and does not overwhelm the setting.

Precast concrete states its case beautifully at the Aurora Colorado Municipal Justice Center.[5] The combination of color, shape, and texture, showcases the ability of architectural precast concrete to meet the designer's imaginative demands. A large passageway frames the main entrance (see Fig. 14), involving architectural precast concrete which forms the columns and fascia beams. The project consists of four main parts, namely, a detention facility, the courthouse, an addition to an existing police station, and the rotunda.

The majority of the panels are load-bearing window-wall units, which are two stories high and weigh 20,000 lbs (9070 kg) each. Boldly detailed with bullnoses, cornices and friezes, their cream-colored appearance succeeds in looking like limestone. Similarly, beveled reveals up to 10 in. (254 mm) wide vertically score the centerline of each panel to emphasize the play of sunlight and shadow on the building's monumental façade (see Fig. 15).

The W Hotel in San Francisco, California was conceived as a modern piece of urban design for a prominent downtown corner site. It is flanked on one side by boldly massed brick-faced precast panels on the Museum of Modern Art and has, as a nearby neighbor, an Art-Deco designed, 1920s style, high-rise building. To compliment these prominent neighbors, the architects generated a podium and tower design with boldly massed pure forms articulated to reflect a latent classical appearance (see Fig. 16).

Important portions of the elevations, including the main entrance, street-front restaurant, and penthouse, were modeled as temple-like facades. The tower was given deep V-shaped scoring to emphasize its verticality. The

Fig. 16. W Hotel, San Francisco, California.
Architect: Hornberger & Worstell, San Francisco, California.

Fig. 17. Façade has a stone appearance with two depths of sandblasting.

Fig. 18. University of Illinois Molecular Research Biology Building, Chicago, Illinois. Architect: Lohan Associates, Chicago, Illinois.

precast concrete panels (finished in white concrete with fine, black gray and terra cotta aggregate) were formed to look like blocks of bearing stone that resemble the granite used in many of San Francisco's civic structures.

The appearance of stone detailing was enhanced by treating the surface of the panels with two depths of sandblasting (see Fig. 17). A medium sandblasting of the typical surface created the look of a thermal finish, while a light sandblasting of the back face [3 in. wide by 2 in. deep (76.2 x 50.8 mm)] reveals at the lower levels, was used to give the impression of oversized mortar joints.

The unity of pure geometric forms and bold classical articulation has successfully established this building as an anchor in this prominent site. This success was made possible by the functional uses of plastic and sophisticated material compositions of precast concrete.

The University of Illinois Molecular Research Biology Building, Chicago, occupies a prominent location on the west campus of the University of Illinois downtown Chicago campus (see Fig. 18).[6] The real design challenge for the building was based on the area's extremely eclectic architectural styles. Most of the buildings date back to the 1920s and 30s and feature a variety of brick and precast design motifs. There is no dominant image to play off. The architects' goal was to create something that would be compatible with this diverse group of buildings yet project a distinctive campus image with visitors.

Fig. 19. Articulation of the façade creates design interest.

Fig. 20. Double-helix shape staircase.

Fig. 21. Saks Majestic Square Complex, Charleston, South Carolina. Architect: LS3P Associates, Ltd., Charleston, South Carolina.

The architects created a lot of design interest in the articulation of the façade. By adding varying colors and finishes to the panels based on each panel's location, themes were picked up from nearby buildings without detracting from the overall look (see Fig. 19). The result is that each façade is compatible with its surroundings and looks like it belongs in the area.

The base, a sandblasted granite aggregate finish, invites visual interest for pedestrians. The mid levels feature an acid-etched granite aggregate that provides subtle, rich, red tones to integrate with the masonry on existing buildings. The top features an acid-etched white sand with a mild pink cast that was used primarily on laboratory sections, conveying a crisp look. Amber-tinted windows reinforce the color scheme.

The biggest challenge for the precaster, as well as the most striking element in the design (see Fig. 20), was the interior circular stairway that rises through the facility. This double-helix shaped stairway with a distinctive smooth finish distinguishes itself from the three finishes used on the exterior. Visible from the outside of the building and illuminated at night, the stairway serves as a focal point for the structure, with its double-helix design suggesting the role of DNA in biological research.

The Saks Majestic Square Complex occupies an entire block in the historic section of Charleston, South Carolina. The design challenge was to integrate the complex into the small-scale principal retail district at the block's edges. The precast concrete and detailing at the corner entrance depict the tradition of the 19th grand era of late century department stores (see Fig. 21). From the decorative urns at the roof, to the incised lettering, to the terra cotta colored brackets, and the strong cornices at the top of the second floor, this finite detail was available and economical by using precast concrete.

The overall architectural effect of the precast panels on Plaza Moliere Dos 22 in Mexico City, where form and meaning are integrated, gives the building a distinguished appearance that communicates dignity and sobriety (see Fig. 22). The project, which has become a landmark symbol, includes a three-story shopping mall and an 11-story office building in the heart of a major business district. The use of architectural precast concrete panels to clad the buildings created a distinctive look, resembling rough-hewn stones. The panels also comprise the creative geometric shapes that make the complex stand out.

The stone texture of the panels was achieved by using rubber form liners, taken from natural rocks in a basalt rock quarry (see Fig. 23). Detailed engineering and intricate forms were needed to produce panels with deep reveals in false joints and interlocking lateral ends that eliminated any visible vertical joints. The horizontal, vertical, and slanted corner panels were cast in one piece, producing a true "corner stone" appearance.

This project is well detailed and it features interesting textures and forms – which are fairly complicated. The angles, circles, and curved surfaces all are done in a very competent and interesting way. The architect and precaster captured the feel, texture, and warmth of hand-hewed stone. A visitor comes away feeling that's exactly what it is.

The facades of the four-story, block-long, John Pappajohn Business Administration Building at the University of Iowa in Iowa City, are articulated

Fig. 22.
Plaza Moliere Dos 22, Mexico City, Mexico.
Architect:
Sordo Madaleno y Associados, S.C., Mexico, D. F., Mexico.

by a harmonious rhythm of pilasters and windows, symmetry, and classical detail (see Fig. 24).[7] The scale and feeling of the exterior reflect the grace and serene neo-classicism of nearby early 19th Century structures.

The architectural precast concrete components for this project were manufactured with a blend of white and gray cement, a small amount of buff pigment, a light colored limestone aggregate, and an evenly colored natural buff sand. All of the precast panels were lightly acid-washed.

The precast material's extraordinary flexibility allowed considerable design freedom in the detailing of the elements. For example, the pedimented entry gates are executed with classical detailing (see Fig. 25). This traditional design interpretation is juxtaposed with the contemporary elements in the façade. Here, the precast concrete is molded in a modern way, creating a stepped, animated façade rather than an unrelenting flat surface. The precast concrete has an especially strong expression in the rusticated base of the building, which conveys the strength, solidity and mass of the structure.

The color adjustability of the precast concrete provided great flexibility with the color palette. The architects matched the color of surrounding structures very closely, which was extremely important in helping this large new building blend harmoniously with its neighbors.

As with many college campuses, Duke University's West Campus in Durham, North Carolina, features a general architectural theme and many variations on that theme.[8] Due to changing tastes, cost constraints, and material availability, a variety of styles have been created through the years. But the new Terry Sanford Institute of Public Policy has re-established a strong design sense (see Fig. 26).

The older campus buildings are richly detailed with pitched roofs, Gothic towers and window tracery. The new building manages to recall the original stone Gothic motif of the

Fig. 23. Form liners were used to achieve stone texture of panels.

Fig. 24. John Pappajohn Business Administration Building, University of Iowa, Iowa City, Iowa. Architect: Neumann Monson Architects, Iowa City, Iowa.

campus by combining German limestone pieces, which were set into the architectural precast panels during fabrication. The German limestone replicates the coloring and texture of the original Duke stone. It connects both visually and symbolically to the old campus.

Calakmul Corporate Center in a Mexico City suburb is a corporate center and landmark symbol for a new development area (see Fig. 27). The building is integrated to the landscape by the use of architectural precast concrete panels in an innovative form and expression. The pyramid-shaped building holds exhibition areas, show rooms and a multiple-use auditorium.

Fig. 25. Classic detailing of pedimented entry gates.

The cube-shaped building is eight stories high, topped with a penthouse, and will be used as corporate offices. Waterfalls cascade onto the floor inside the circular openings of the four walls, then flow into reflecting pools in the main plaza.

The building is conceived like a harmonic complex of volumes linked with space, relating the parts to the whole. This was made possible by combining shapes, symbols, and precast materials in a monumental structure. Three elemental forms, namely, the square or cube, the triangle or pyramid, and the circle or sphere exemplify forms and volumes of the ideal platonic solids. The ideal conception was to combine these basic forms.

The architectural symbolism has striven to communicate the earth as an imaginary square pointing towards the solstice corners; the sky as a circle representing the heavenly dome with the circular movement of the stars; and the pyramid as representing a visual and metaphysic language of fire and light.

The combination of white and gray-crushed marble aggregates and sand mixed with white and gray cement, was used to match the surrounding landscape and the design concept of natural stone – crucial in giving the buildings the right color blend. The architect sought texture and brightness

Fig. 26. Terry Sanford Institute of Public Policy, Duke University, Durham, North Carolina.
Architect: Architectural Resources Cambridge, Inc., Cambridge, Massachusetts.

Fig. 27. Calakmul Corporate Center, Mexico City, Mexico. Architect: Agustin Hernandez N., Mexico, D.F., Mexico.

Fig. 28. Center of Science & Industry (COSI) in Columbus, Ohio. Architect: Arata Isozaki & Associates, Tokyo, Japan. Project Architect: NBBJ Architects, Columbus, Ohio.

for the desired reflection of light by using a medium-deep surface texture achieved with pneumatic chisel tools. The marble chips shone when the skin was broken off the precast panels. The architect also requested that slight color variation be randomly added to the panels in order to attain the natural pyramid stone effect.

As can be seen, improvements in fabricating processes allow architectural precast concrete to be created in almost any color, form, or texture – whatever is most aesthetically pleasing. In addition, concrete's moldability offers the freedom to sculpt the structure's façade in very imaginative ways. This ability to achieve totally customized elements makes precast concrete different from any other exterior cladding material.

Take Columbus Ohio's Center of Science & Industry, for instance. This structure was designed as an elliptical curve that includes a discontinuous "clothoid" curve from ground to roof (see Fig. 28).[9] Each quadrant of pre-

Fig. 29. Museum of Modern Art, San Francisco, California. Project Architect: Mario Botta, Lugano, Switzerland. Architect of Record: Hellmuth, Obata and Kassabaum, San Francisco, California.

cast panels making up the façade was placed along segments of six curves to produce the elliptical shape. The wall panels also curve vertically into the building along segments of two other circular curves.

Structurally, the curved panels act as loadbearing members to support the roof. Conceptually, this building's look combines two distinct aspects of architecture: its universal grammar, such as basic geometry and general organization of space, and the acknowledgment of incorporating local materials and site restraints.

Precast concrete can be faced creatively with a wide variety of other cladding materials. Architects are incorporating the pleasing appearances of traditional cladding materials such as dimensional stone, brick, tile, and even terra cotta, with the strength, versatility, and economy of precast concrete. For example, the patterned façade of the San Francisco Museum of Modern Art has 1 in. (25.4 mm) thick brick on 9 in. (229 mm) thick precast concrete panels (see Fig. 29).[10] Most panels measure 10 x 28$^1/_2$ ft (3.05 x 8.69 m) and contain 1500 to 2300 bricks per panel.

Architectural precast concrete manufacturers have responded to the demand for more color choices by offering a wide variety of colorful ingredients. Various cement matrix colors, a multitude of colorful stone aggregates and sands, and a wide range of stable pigments allow the designers to create exactly the color needed. Fig. 30 shows the occasional use of two or more different colored-mix recipes in a single precast piece.

A designer can achieve strikingly different colors and textures from a single precast mix simply by varying the finish treatment. The single concrete mix shown in Fig. 31 has three different finishes. This multiple-finish technique offers an economical, yet effective, way to heighten aesthetic interest.

Signs of age etched in city grime are often a disconcerting note in an era of eternal youth. Discussions of measures used to counteract atmospheric stain elicit, for the most part, a "We can live with it" attitude. Sloping sills just invite soot to lay on them, and the rain is

Fig. 30. Several different mixes are used in a single panel.

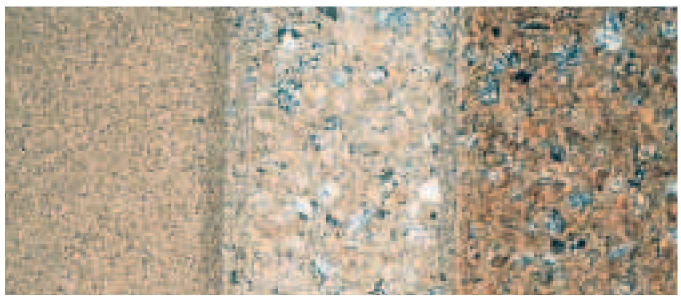

Fig. 31. From left to right, the finishes are acid etched, sandblasted and retarded.

Fig. 32. Aesthetics can be destroyed by lack of detailing for weather.

going to streak the face (see Fig. 32). Stains from weathering can be reduced by proper detailing. There is a need for designers to make provisions for carrying down rainwater to minimize streaking.

CONCLUDING REMARKS

Many of the issues discussed in this article affect the ultimate application of architectural precast concrete in any specific design. If a precaster influences a job, it is important that the architect find the most qualified producer. This is because the technology of precasting is quite complex. However, with the right precaster, the ensuing quality and aesthetics of the job will be well worth the effort.

This article has attempted to show how the proper use of architectural precast concrete can produce aesthetically pleasing structures. Today, the technology is sufficiently advanced whereby a large variety of solutions are avaibable to the architect.

Long ago, Goethe said that, "The main challenge of any art is to cause by appearance, the illusion of a higher reality." As the new century begins, those wise words will continue to have relevance.

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