



# A Tale of Two Concretes

*MetaMax HRM® improves performance and beauty in two very different types of concrete projects.*

**By Michael Chusid**

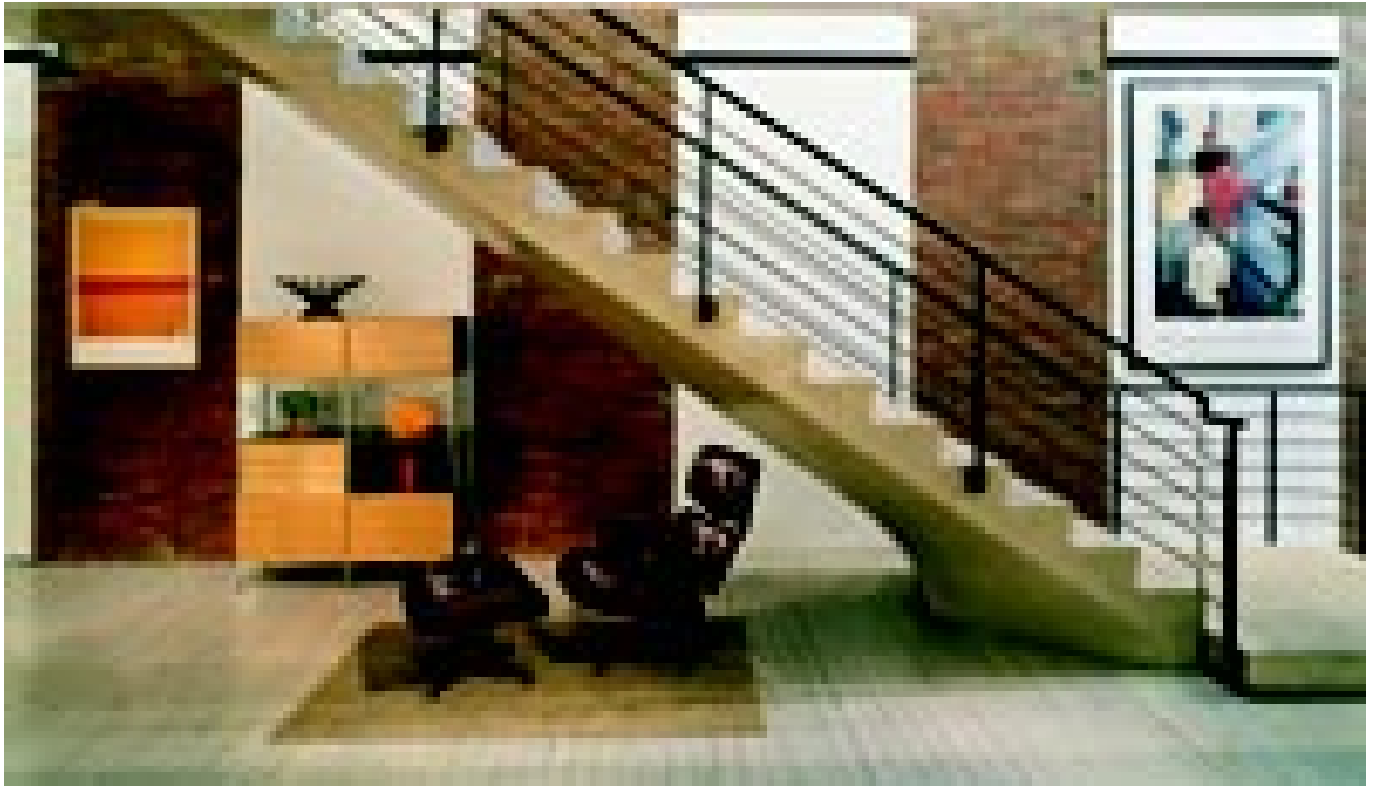
Two recently completed concrete building projects in New York City could not be more dissimilar. One, in trendy Soho, for the Museum of Modern Art, cleaves to a reinterpretation of a modern aesthetic that is lean and devoid of applied decoration. The other, a restoration of an almost century-old Upper West Side condo, preserves the ornate style of a by-gone era. The first is the epitome of hand-crafted, one-of-a-kind, cast-in-place concrete; the latter utilises a variety of techniques to produce decorative precast concrete elements.

Yet on closer examination, the two projects also have much in common. Both recognise concrete as a design medium capable of surprising beauty. Both require hard, durable finishes that will withstand punishing wear and tear. Both are the product of the union of a design team and a concrete producer who are passionate about advancing the latest in concrete construction. And both are among the small but rapidly growing number of concrete projects that take advantage of MetaMax® high reactivity metakaolin (HRM) to achieve their ends.

MetaMax HRM, manufactured by Engelhard Corporation, is an ultra-fine pozzolanic concrete additive that enhances the strength, durability and workability of portland cement concrete and cement-based products. Unlike most highly reactive pozzolans, MetaMax is a bright white powder and will not darken the appearance of concrete. This makes it an ideal choice for use in architectural concrete where visual and aesthetic concerns are critical.



*Image of concrete stair © Peter Aaron/Esto*



The stair for the MoMA project comprises a dramatic yet comfortable concrete stair that cantilevers as a sculptural element out of the lower floor (Image © Peter Aaron/Esto).

### *Early pioneer*

Alan Bouknight, president of Azzarone Contracting Corp., Mineola, NY, is one of the early pioneers to embrace the potential of MetaMax. As the third generation to run the 50 year-old family business, Bouknight might as well have been born with concrete in his blood. And with college degrees in geology and geo-chemistry, he also has a material scientist's grasp of concrete technology. He takes an empirical approach to concrete, constantly testing new admixtures and tweaking mix designs to "enhance concrete for the good of the concrete," as he describes his passion. So far, he says, MetaMax has passed all his tests. "I made samples with MetaMax and put them out in the yard to watch how they fared. After more than three years of exposure to the elements, they show none of the pitting and deterioration we get with typical concrete in our harsh urban environment."

Like many small business owners, Bouknight has to wear multiple hats. As a technician, he claims

that "MetaMax helps make concrete harder, denser, and less porous, so our concrete is more durable and resistant to corrosion, efflorescence and cracking." For this reason, he now uses MetaMax in a wide range of applications, ranging from utilitarian projects like foundation walls to high-end projects like the exposed concrete floor in an Armani Casa boutique and the outdoor pool deck for a custom beach-front residence.

As a businessman, Bouknight is enthusiastic about how concrete with MetaMax handles on the jobsite. "It gives the concrete more butter," he says, using the industry's jargon for a concrete mix that has a thick, rich cement paste that is easy to pump and finish.

But it is as an artist that Bouknight is most effusive, describing his work with phrases such as, "the Zen-like qualities of concrete." "MetaMax," he says, "enables me to coax out the inherent beauty of concrete in subtle ways. In New York, for example, most concrete is a clinical, grey colour. But by using white portland cement and MetaMax, we can produce beautiful opalescent finishes. Plus, we can tint the concrete to get just the right shade we need."

## *A CONCRETE STAIR*

A prime example of Bouknight's craftsmanship is the concrete stair at the focal point of the Museum of Modern Art (MoMA) store in New York City's Soho district. The store, which opened in 2001, was designed by 1100 Architect. The New York-based architectural firm practices what they describe as, "an aesthetic that advocates luxury with sensuous restraint," and, "a poetry of well-honed, definitive elements - a spare elegance of proportion, clean but not minimal lines, and forthright use of materials."



**Built in one continuous pour, the flight's 24 inches thickness at the bottom sweeps to a mere four inches at the top and is shaped to resemble the keel of a boat (Image © Peter Aaron/Esto).**

The MoMA project occupies two levels of an existing building. This made the stair a crucial design element, according to Juergen Riehm, a partner in the design firm. "We had to make it compelling so customers would be drawn to the upper level," he explains. His solution was to create a dramatic yet comfortable stair that cantilevers as a sculptural element out of the lower floor. Concrete was chosen since it satisfied structural requirements and could be moulded into a form that Riehm explains, "creates a wonderful juxtaposition" with the Eames chairs and other designer furniture on the lower level. Built in one continuous pour, the flight's 24 inches thickness at the bottom sweeps to a mere four inches at the top and is shaped to resemble the keel of a boat.

"We wanted a concrete that was light in colour and had a warm, stone-like appearance, like a buff limestone," said Riehm. "It not only had to be visually pleasing, but also tactile and warm." He specified that the underside and edges of the stair were to be very smooth and have a satin-like finish, while the treads and risers were to be ground like terrazzo to expose a subtle blend of light grey and buff aggregates.

Bouknight responded by creating samples and a mock-up for the architect to consider. Beginning with white portland and iron oxide pigments to create the desired shade, Bouknight explains that he also added MetaMax to the concrete mix. "It made the concrete creamier and more consistent so we could create an ultra smooth surface without flow lines or objectionable blemishes. Plus the bright white MetaMax helped intensify the colour we were after." The stair was then cast on formwork built out of plywood and timbers and plastered with auto body compound to the desired curvilinear shape. The surface was sanded smooth, then coated and heavily sealed to create a smooth sur-

face against which the concrete could be cast.

MetaMax also hardened and densified the concrete to help resist wear on the stairs. Riehm says MoMA "wanted something that would wear well and would not have to be resealed every month." Two years after the project opened, he says the industrial wood floors in the building are starting to show wear, but, "with its integral coloration and high density, the concrete has worn very well." Bouknight admits that MetaMax added to the cost per cubic yard for the concrete, but feels that it is an investment that makes sense for "any owner who is concerned about the performance of the concrete over the life of a project". He reminds us that the stair was manufactured on site. "Since we cannot always control job site conditions, we place a premium on the quality of the materials we use," he stated.

## *CONCRETE FOR A LANDMARK*



While the stair was being constructed downtown, a different type of concrete work was being installed uptown. Glass fibre reinforced concrete (GFRC) and precast concrete, also known as cast stone, were used at the Alwyn Court at 58th St. and 7th Ave. to replace deteriorated terra cotta elements in the building's facade. Alwyn Court was originally constructed in 1908 with a terra cotta facade that contained, "a dizzying array of sculptural and ornamental themes," according to architect Charles DiSanto, principal of Walter B. Melvin Architects, LLC, New York. With the building's shell showing serious deterioration due to years of deferred maintenance, he was hired to develop a restoration plan for the co-op apartment building.

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Due to the landmark status of the building, DiSanto says, “We tried to replace deteriorated facade elements with matching terra cotta as much as we could. But where scheduling problems and building conditions made terra cotta impractical, we had to utilise alternative materials including GFRC and precast.” By using GFRC, for example, DiSanto was able to get all the pieces of a window lintel fabricated as a single unit. It was much easier to install the lightweight GFRC lintels than it would have been to retrofit anchorages for a large number of individual terra cotta elements.

DiSanto says the alternative materials presented two challenges. First, the concrete had to be visually indistinguishable from the terra cotta. And second, he had to have confidence that the replacement materials could resist New York’s polluted atmosphere and freeze-thaw conditions. This is why David Kucera, president of David Kucera, Inc., Gardiner, NY, suggested the use of MetaMax in the concrete.

#### *A precaster’s experience*

Kucera specialises in making GFRC and precast for complex restoration projects, and supplied both materials for the Alwyn project. He started using MetaMax four years ago after a rigorous testing program convinced him that MetaMax significantly improved the durability of GFRC. Since

then, he has started using between 10 and 20 percent MetaMax in almost all his products. He explains that the benefits of MetaMax result from its highly reactive pozzolanic nature. “It reacts with the free lime particles created during portland cement’s curing process. Because there is less free lime, there is less chance of efflorescence. The pozzolanic reaction also densifies and hardens the cement paste so the concrete is stronger and has lower porosity.” Using MetaMax in conjunction with other additives, Kucera says his concrete has compressive strengths over 6,500 psi and only half the water absorption of ordinary concrete.



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“These improvements,” he points out, “makes my concrete more resistant to acid rain, but they also make it more difficult to use an acid wash to expose the aggregate. I now have to work twice as hard to remove the cement paste.” He admits that this is an ironic testimony to the effectiveness of MetaMax. On the other hand, he says MetaMax simplifies the use of sandblasting to create an exposed aggregate finish. “The harder cement makes it easier to keep an edge on a piece, and corners don’t get rounded off as easily.”

While other pozzolans such as fly ash and silica fume can also improve concrete, Kucera says he would never consider using them. “The other pozzolans are grey and aren’t oriented towards controlling colour. We prefer white cement and white metakaolin because we need to start at a clean point when we match colours.”

He also notes that, MetaMax “helps with colour consistency by

facilitating colour distribution throughout the mix.” He attributes this, in part, to MetaMax being very fine powder that creates a different particle size distribution than in ordinary concrete mixes. He says, “It gives a milky paste on the surface with more fines.” Many of the precast elements he produces, “have a form finish, and regular concrete can look mottled with a form finish. But MetaMax tends to make our concrete look more consistent.”

#### *Now and always*

DiSanto says, “What Kucera does very well is match the colour and texture of new materials to existing materials.” But for the Alwyn restoration to be successful, it is essential for the concrete to continue to blend in with the terra cotta for decades to come.

Terra cotta has a vitrified, glazed surface that resists water absorption and staining. Conventional concrete, on the other hand, is porous and easily stained. But both DiSanto and Kucera are optimistic about the predicted performance of the MetaMax-modified concrete. DiSanto notes that, “the concrete is so dense and smooth, it is almost like a glazed surface. So as they age and get dirty, the replacement pieces will get dirty in a way that is similar to the original materials.” Kucera rhetorically asks, “Using metakaolin, will concrete weather exactly like terra cotta? No. But with MetaMax and the other additives and sealers we use, our water absorption rate is very low. What does that mean? It means the concrete will have a longer life span and will remain looking the way it is supposed to look.” Kucera draws confidence from another restoration project in New York where MetaMax was also used in GFRP. That work, he says, “was done ten years out and the concrete still looks the way it did when it went in.”



In recognition of the outstanding craftsmanship on the project, Alwyn Court received a restoration award from New York Landmarks Conservancy.

According to Kucera, “When you look at Alwyn Court now, it looks like a nice, clean, well kept building. You can’t tell there is concrete mixed with terra cotta.” In recognition of the outstanding craftsmanship on the project, it received a restoration award from New York Landmarks Conservancy. What, DiSanto says, was once the most beautiful terra cotta building in New York is now the most beautiful terra cotta and concrete building in the city.

### *Final analysis*

In the final analysis, what the MoMA and Alwyn projects have in common is a reminder that the best practices in concrete construction are constantly evolving as new materials are tested and proven in practice. This is demonstrated by Riehm who says that exploring innovative ways to use concrete has always been a hallmark of his firm’s oeuvre; he even met his partner back in the early 1980s when they worked together to build one of the first concrete kitchen countertops. Concrete counters are now an established design option, and the search for new ways to express concrete continues. “It is very important that concrete stay true to its nature and is used purposely to achieve an effect,” Riehm opines. Reflecting on his first experience with MetaMax, he concludes, “It’s about the refinement of what would otherwise be an ordinary material.”

### *About the writer*

Michael Chusid is an architect and certified construction specifier, and serves on the Concrete Aesthetics Committee of the American Concrete Institute. His company, Chusid Associates, evaluates new construction technologies and provides architectural and technical consulting services.



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