



POLISHED CONCRETE FLOORING PROJECTS SURGE



Corning Museum of Glass – Corning, NY



Calcium sulfoaluminate (CSA) cement-based products are increasingly the key to achieving demands for both new and renovated construction

Projects throughout the United States showcase how construction materials are playing a supporting role in industries where new technology rollouts, tight timelines, and sustainable design are the new norm. Fast-setting, calcium sulfoaluminate (CSA) cement-based products are increasingly the key to achieving demands for both new and renovated construction.

Constant implementation of new technologies means less standardization across industries and greater uniqueness on the jobsite. Unfamiliar workflows and logistics, unusual jobsite conditions, and untried building systems are day-to-day realities. By investigating how materials can meet job requirements, projects can be completed to meet demanding timelines and damaged structures can be salvaged and restored to their original beauty.

Also referred to in the industry as ‘hydraulic cement-based,’ CSA cement products are increasingly becoming part of these jobs. They have provided architects and contractors with the ability to produce beautiful flat, polished floors in a fraction of the time, with considerably less expense, than using portland-cement-based concrete and constructing entirely new floors.

This article shares examples of unique jobs that used a variety of advanced high-performance fast-setting cement products to meet the needs of the project and its schedule.

CSA-based cement products

Portland cement has been the standard for many years, but it always brings certain challenges. It shrinks excessively, cannot be accelerated without negative effects, can be susceptible to attack by prevalent chemicals, and reacts destructively with certain aggregates. Using calcium products based in calcium sulfoaluminate cement can help solve these problems.

CSA cements are manufactured with similar raw materials, equipment, and processes used to make portland cement. The chemistry includes calcium sulfoaluminate (C_4A_3S) and dicalcium silicate (C_2S). The C_4A_3S compound hydrates to form beneficial ettringite—a strong, needle-like crystal that forms very quickly to give the material its quick-setting and high-early-strength properties.

Another significant aspect of the chemistry is the absence of tricalcium aluminate (C_3A), which would be present in portland cement and makes that material susceptible to sulfate attack. The fact CSA cement products have little or no C_3A makes it very durable in sulfate environments.

When CSA cement is used in concrete, it provides superior performance in terms of rapid strength gain, reduced permeability, and low shrinkage. Traditionally, when fresh concrete is placed, the heavier particles settle and displace the mix water. The water then forms capillaries as it rises to the surface as bleed water. After the concrete has hardened, these capillaries become routes of entry for substances attacking the concrete and reinforcing steel. As CSA cement concrete is placed, the ettringite crystals rapidly consume water and create a three-dimensional lattice. This stops the settling and displacement process, eliminating capillary formation. The elimination of capillaries reduces permeability, resulting in more durable concrete.

CSA cement-based concrete is more efficient at using mix water than portland cement. This efficiency allows the placement of the concrete in a very workable consistency without the detrimental effect of convenience water. Portland cement will consume about half the mix water,



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leaving the convenience water to evaporate over time, causing drying shrinkage. At modest water-to-cement (w/c) ratios, CSA cement-based concrete will consume all the water in the mix, greatly reducing drying shrinkage.

CSA cement is a highly versatile material used to formulate mixes for a wide range of applications.

Reviving a historic building

Every year, the National YoungArts Foundation receives thousands of applications from high schoolers who excel in the visual, literary, design, or performing arts. The foundation selects 800 of those students to attend its programs, work with master artists, and present their art on a national scale.

With such a thriving curriculum, the foundation was in need of a national headquarters. It acquired the Bacardi Tower and Museum buildings in Miami—two structures that were granted historic designations by the City of Miami Preservation Board. Renovations undertaken by the foundation, therefore, had a dual goal: create a multidisciplinary cultural center and preserve the architectural masterpieces. A key to maintaining the purity of the building's modernist style was to achieve smooth, level interior floor surfaces with decorative polished overlay areas.

The seven-story rectangular tower—its well-known north and south walls adorned with painted murals comprising more than 28,000 blue and white tiles—underwent construction beginning in September 2013. To achieve smooth, level interior floor surfaces with decorative polished overlay areas, advanced high-performance fast-setting cement products were employed to both underlay and overlay the original floors. The use of these products allowed for the floors to quickly

be leveled and polished without the time and expense of installing new floors. CSA cement achieves structural strength within hours and can be polished or receive a floorcovering the next day—a necessity for this project's schedule.

The first floor was overlaid with a gray, integrally colored, CSA cement-based, self-leveling topping, resurfacer, and underlayment, and polished to a 1500-grit. The second floor required a CSA-based self-leveling underlayment (SLU) to raise the level of the floor to receive the polishable topping. The sixth floor was leveled with an SLU, in thicknesses ranging from 6.4 to 127 mm (¼ to 5 in.). A wood and epoxy floor system was then installed.



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The underlayment was the foundation for the floor that received another covering, such as overlay, tile, or carpeting. (In this case, it was the gray self-leveling topping that was the overlay.) While there are different methods to polish an overlay, the recommendation was to mechanically diamond polish the floors to achieve the 1500-grit polish that would produce a mirror surface. A chemical applied and then buffed will not achieve the same level of polish. Engineers are typically specifying the polish process now to ensure the correct grit level of polish is achieved.

The products were mixed and installed using mixers, gauge rakes, and metal spike rollers. More than 1600 bags of advanced, high-performance, CSA cement products were used in total. The Bacardi Tower renovations were completed in February 2014 and now house the YoungArts Gallery, a restaurant, and staff offices.

Refurbishing floors for new use

In 1890s New York, the Terminal Warehouse Company's Central Stores building offered ample storage for goods passing through the Chelsea District's freight yards. Covering an entire city block, the building is in the process of being refurbished and already houses a variety of shops, galleries, and offices. The central 'tunnel,' which once provided ingress and egress for trains, will now be used as event space.

Concrete floors provide much of the chic industrial character for this venue, but they were badly worn and damaged in some spots. Paul Huneck, a specialist in decorative concrete and owner of Hudson Concrete in New York City, was called on to give new life to the surface.

To meet the needs of the schedule, CSA-based cement products were used. This allowed the floors to be polished after one day, whereas the contractor may have to wait at least 28 days with traditional portland cement, holding up the project.

First, a high-performance CSA-based concrete repair material was used to fill in deeply pocked areas. The floors were very uneven and needed to be repaired prior to application. Therefore, they were shotblasted between each lift to ensure the overlay would adhere. The process mechanically breaks up the weak areas of the concrete and then vacuums up the surface so it is clean and ready for the underlayment. (Generally, surface preparation should be to International Concrete Repair Institute's [ICRI's] Concrete Surface Profile [CSP] Level 3.) Approximately 600 bags of the mix were also employed to fill raised dais areas (e.g. platforms) that were being built into the new event space.

A total of three lifts of concrete repair products were needed to provide a smooth finished floor. Thirty-four kits of two-component, low-volatile organic compound (VOC), moisture- and alkali-insensitive epoxy primer were placed with a sand broadcast to create a textured surface and promote the adherence of each successive lift of product. A first lift of CSA-based SLU was applied to even out extremely low areas of the floor, followed by a second lift that completely corrected elevation discrepancies. In the end, 350 bags of this SLU were used. The same mechanical surface preparation of shotblasting was done between each layer to promote bonding. No testing was needed on this job—testing is only done if the original concrete is very soft or if there are oils spots on it.

A third lift of an advanced CSA-based topping with 325 bags of product was then used. It was mixed with a customized integral color and four



Historic Bacardi Tower – Miami, FL



Bauer Hockey – Burlington, MA



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different light-colored sand aggregates. To finish the surface, the floor was polished to a 3000 grit. A densifier and polish guard were then applied. There were no compatibility issues with these products since most densifiers and polish guards are formulated to work with all concrete types. Additionally, the densifier and polish guard had been previously used on this type of overlay.

The result is an expanse of beautifully polished floors with new life for their innovative use as an event space.

Skating to the finish

Ice hockey equipment manufacturer Bauer Hockey announced plans to open a chain of 'Own the Moment' retail stores, with the first opening in the Boston suburb of Burlington. The 1860-m² (20,000-sf) stores include indoor ice rinks, so customers can test ice skates and equipment under the guidance of highly trained associates. With the first store serving as the prototype for eight to 10 additional stores in key markets, the look had to be right.

Bauer was searching for a natural, high-shine, polished concrete floor, but the space consisted of

an old beat-up concrete slab with many trenches throughout from past and present tenants. Industrial Concrete Services (based in Gorham, Maine) presented CSA-based self-leveling topping to be installed over 1070 m² (11,500 sf) of floor space with multiple colors and polished at the Burlington store. With the floor samples and the selected colors chosen, the project was approved for a very aggressive construction schedule prior to the fixtures arriving for installation.

CSA cement topping is known for being fast-setting to the point where it can be polished the next day, making it ideal for the aggressive schedule. Additionally, it can be placed at a 9.5 mm (3/8-in.) thickness, where traditional portland cement concrete would be placed at a minimum of 50 mm (2 in.).

As part of the training, the product representatives and the distributor helped in the pouring and application process of the overlay and later with the polishing, which included the retail space floors and all walkways throughout, leading to the ice rink. The work included five separate pours and two different colors to create the aisles, along with a broad-cast river stone aggregate

used to produce a terrazzo-like floor appearance. The process was challenging, like all fast-paced construction projects, as the crew had to work around other trades that also needed the floor space to perform their work.

For an old cooler area that needed to be leveled with the rest of the floor, 300 bags of SLU were used. The calcium sulfoaluminate-based product is durable in both wet and dry environments. It is an excellent choice for new floor projects requiring long flow life and working time. The material rapidly levels, maintains workability for 30 minutes, and produces a flat, strong surface with high bond strength. It can be covered with finished flooring in six to 16 hours at 21° C (70° F), depending on the floor type.

For the polishable overlay, the team used a CSA-based self-leveling topping that is crack-resistant, durable, and will not deteriorate in damp conditions. It is suitable for projects demanding long flow life and working time while achieving high early strength—this is very important for polishing the material. The topping also cures to a light off-white color ideal for stained, dyed, or integrally colored floors. Additionally, since it grinds and polishes well, it was an excellent choice for this project. Bauer Hockey now plans to specify the CSA-based self-leveling topping when renovating its stores.

This overlay has been used successfully in very demanding conditions on big-box grocery, retail, and industrial floors.

Complementing beauty

When the Corning Museum of Glass (Corning, New York) opened its Contemporary Art+Design Wing in 2015, it was considered the largest space in the world devoted to the display and creation of contemporary art and design in glass. The \$64-million expansion features a 9300-m² (100,000-sf) addition, which includes 2415 m² (26,000 sf) of gallery space and a 500-seat live glassblowing demonstration facility. The wing provides visitors with a day-lit environment in which to experience contemporary art and design in glass from the past 25 years.

The building façade is constructed of large, white-glass panels that create a nearly seamless, softly reflective expanse. Inside, the building features a simple, white interior. The galleries are defined by massive, curved concrete walls that serve as the supports for the skylight roof. Concrete beams that are 90 mm (3 1/2 in.) thick and stand 1.2 m (4 ft) tall rest on the curved gallery walls and diffuse the light as it comes through the skylights,



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directing the light to the white concrete floor where the glass is displayed.

Since the walls are bright-white plaster, the architect wanted an extremely light-gray concrete floor for subtle contrast. The original design had specified a slag cement mix to provide that hue. However, the ready-mix supplier was not able to provide the slag cement until much later than needed. Waiting for it would have jeopardized project scheduling and completion time.

After several unsatisfactory concrete slab mockups, contractor D.J. Rossetti (Malta, New York) recommended using CSA-cement-based self-leveling topping with integral color. The pigment was matched from a paint color to achieve the architect's desired look.

This self-leveling topping, resurfacer, and underlayment is an advanced calcium sulfoaluminate cement material that is crack-resistant and durable. For this project, the speed of the polishable topping helped meet the tight construction schedule. The one-component system cures to a light off-white color ideal for stained, dyed, or integrally colored floors. With the addition of custom pigment, it cured to a very light gray (almost white) that was ideal for the light-filled space.

Before installing the self-leveling topping, the D.J. Rossetti crew performed surface preparation by using a grinder with 25-grit metal diamonds. Next, the team applied a two-component moisture- and alkali-insensitive epoxy primer. The primer seals porous concrete so floors can be installed in as few as 12 hours. There were no concerns with moisture vapor transmission since the overlay and epoxy primer are not sensitive to moisture.

As long as the topping is cement-based, there can be up to 9 kg/92m² (20 lb/1000 sf)/24 hours of moisture vapor transmission. The installers also broad-casted 20/40 mesh sand to increase adhesion to the topping.

Crew members then placed the topping and used spike rollers to release any trapped gas. This self-leveling topping rapidly levels, maintains workability for 30 minutes, and produces a smooth, strong surface with high bond strength. It can be ready for foot traffic in two to three hours, and for coatings in about 12 hours. For flat surfaces, one 23-kg (50-lb) bag covers 2 to 2.2 m² (22 to 24 sf) at 6 mm (1/4 in.) thick, and 1 to 1.1 m² (11 to 12 sf) at 13 mm (1/2 in.) thick. For this 2415-m² (26,000-sf) project, workers used 1850 bags of product; it was mixed via portable mixer and placed at 9.5 mm (3/8 in.) thick, covering approximately 1.5 m² (15 sf) per bag.

Since the architect wanted a low-sheen finish, the contractor used a grinding machine with diamond tooling to polish the concrete to a matte sheen. The crew first used 80-grit metal, then 150-grit metal before moving onto 50-grit resin and finally 100-grit resin. The result is refined concrete flooring that acts as a sophisticated canvas for the museum's glass art.

"With the opening of the new wing, we are able to display and interpret contemporary art and design in glass in the same elegant and thoughtful way in which it is being produced," says Tina Oldknow, the museum's senior curator of modern and contemporary glass.

Continuing to provide solutions

The marketplace will continue to challenge architects and construction professionals to find solutions meeting modern demands. With products that address a variety of needs, projects ranging from floors to building structures can be renovated rather than torn down and rebuilt. By using fast-setting materials to reduce downtime, projects can be completed in a fraction of previous timeframes. These time-saving materials provide for a range of architectural touches, including an array of decorative finishes, including colored and polished overlays. These new solutions are encouraged for architects and contractors pursuing economical and sustainable paths to their renovations.

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Jose Ruiz, eastern regional manager packaged products for CTS Cement Corp. (Cypress, California), has been working and/or involved in the concrete construction and restoration industry for more than 20 years. Ruiz joined CTS in 2008 and has been instrumental in the company's expansion and growth. As a regional manager, he works with the sales team to expand market growth and manage product sales. Ruiz also works closely with construction industry leaders and construction material suppliers to provide support and solutions for their everyday projects.

CTS Cement Manufacturing Corp. is the leading manufacturer of advanced calcium sulfoaluminate (CSA) cement technology in the United States. Our Komponent® and Rapid Set® product lines are renowned for proven performance, high quality, and exceptional service life. Contact CTS Cement for support on your next project. Call 1-800-929-3030

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