



CalStar brick come in eight colors, all of them green. Mineral oxide pigments used have a track record of decades.

Fly Ash brick

Sustainable Construction

New Architectural Masonry Units Lower CO₂, Energy Consumption

By Gene Guetzow, LEED AP, and Julie Rapoport, PhD, PE, LEED AP

Green brick is debuting in the Midwest. This smooth-textured architectural masonry unit made of fly ash is pigmented to match the natural color palette of the region. Its state-of-the-art manufacturing facility, in southeast Wisconsin, will be among the closest operating architectural masonry unit plants to Chicago, Grand Rapids and Detroit. These new fly ash masonry units will be competitively priced with other architectural brick and pavers.

Also, it will be the greenest commercially produced brick in North America.

Made from Class C fly ash, a product captured from the smokestacks of coal-fired power plants, these brick have high recycled content. Their manufacture requires substantially less energy consumption than fired clay brick.

This is good news for the Midwest, where the masonry tradition is deep and strong. In Chicago, a masonry town committed to becoming the most environmentally friendly city in the world, it's especially good news. A truly green brick could marry the region's brick tradition and its green aspirations.

Green Reality

Green construction is no longer a novelty. In some localities, it's becoming a requirement. Chicago, for example, was one of the first cities to adopt LEED for the construction of all new city facilities. Many private owners are following the same path.

This green mandate impacts masonry. It has proven durability; it provides thermal mass and can be part of very energy efficient building designs such as cavity wall. Building operations is one of the largest categories of energy consumption and associated CO₂ emissions worldwide. Atmospheric CO₂ is said to be accelerating climate change. For the same reasons, we must pay attention to the energy consumption and CO₂ emissions associated with the manufacture of the masonry materials we use.

Fly Ash Solution

New fly ash brick (FAB), made in Caledonia, WI, were developed specifically to offer a more sustainable option for today's masonry. These architectural quality fly ash brick slash energy consumption and carbon footprint considerably. FAB have 40% or more post-industrial recycled

content. They do not have an energy-intensive firing process. They do not contain portland cement.¹

Location of the plant was chosen for the combination of a great masonry market and availability of the raw material. We Energies' nearby Oak Creek Power Plant was chosen because it produces a particularly good quality fly ash, rich in calcium. By locating its fly ash brick plant just a few miles from Oak Creek, the manufacturer saves transportation energy and makes its product eligible for the Regional Materials LEED credit on any project within 500 miles of the plant, from Minneapolis to Detroit and as far south as Nashville. calstarproducts.com/leed-calculator shows a 500 radius map from CalStar plant. FAB can also contribute to LEED credits for Recycled Materials and Innovation In Design, among others.

The new fly ash brick have a high-end appearance, not unlike pressed clay brick.

¹A type of brick incorporating fly ash is currently being made in China, India and elsewhere, but these are completely different from the FAB now being produced in the US. Overseas products contain portland cement and use fly ash as filler or aggregate.

Smooth-textured and cored, the appearance is very consistent from brick to brick. They are available in modular and utility sizes.

FAB are made in eight colors, earth tones ranging from light cream to dark brown. The natural color of the fly ash is very close to Milwaukee Cream brick, enabling production of a fly ash brick that will allow that particular Milwaukee masonry tradition to continue sustainably. Colors are achieved using proven mineral oxide pigments produced in accordance with ASTM C979 - 05 *Standard Specification for Pigments for Integrally Colored Concrete*. For example, red FAB use the same red iron oxide that gives concrete brick its red color. These pigments have been employed for many years for integral concrete coloring. They are considered colorfast. Fly ash brick will be cost competitive with other architectural brick. Commercial production began in January. FAB will soon be available throughout the Midwest and beyond.

Performance and Standards

FAB have been extensively tested for compressive strength, freeze-thaw performance and severe weathering. They have very precise dimensional tolerance. FAB are not prone to efflorescence due to a carefully controlled manufacturing process. Professional mason field testing has determined that FAB have good mortar adhesion, are easy to build with and can be cut cleanly. The central innovation of this product is using fly ash as the “active ingredient” in making a strong product. Fly ash has been used as a pozzolanic additive in concrete for decades, but this use is different.

Class C fly ash is self cementing. The fly ash itself is the cementitious material that becomes hard and durable when hydrated and gives FAB its strength and stability. FAB are produced using a proprietary process that includes vibro-compaction and low-heat steam curing as well as special chemistry to achieve performance and consistency.

Fly ash is produced when pulverized coal is burned, consuming most of the carbon in the coal. The remaining fly ash is composed primarily of silicates and aluminates, with



Fly ash brick pavers installed in the first LEED registered home in Winnetka, IL. CalStar pavers in tan, brown and natural.



some significant amounts of calcium and magnesium oxides. This means that from a fundamental elemental perspective, fly ash is similar to clays. However, from a chemical perspective, fly ash hydrates similarly to cement. Fly ash brick is a hybrid technology. The materials are elementally similar to clay but do not require energy-intensive firing. They hydrate similarly to cement but do not require CO₂-intensive calcination.

Safety

Use of fly ash in construction materials is actually one of the best ways to dispose of it. Currently, less than 45% of the more than 70 million tons of fly ash produced annually in the US is used in beneficial applications. The rest goes to landfills or retention ponds. A recent spill at a Tennessee coal ash pond underscored the dangers inherent in this form of disposal.

Sensational publicity around that ash pond spill created the false impression that fly ash contains high levels of heavy metals. In fact, fly ash contains trace amounts of some heavy metals, but these amounts fall far below the thresholds that define a hazardous material in

the ash produced by the great majority of US power plants. Beneficially reused fly ash is not considered a hazardous material by the US Environmental Protection Agency (EPA). Fly ash has a long track record of use in concrete, and has been historically included as a filler in unfired clay brick prior to firing in percentages as high as 6%.

Doing the “right thing” environmentally does not have to compromise aesthetics, performance or budgets

Moreover, incorporating fly ash in clay brick or concrete physically stabilizes the ash, and binds any trace heavy metals. Leading environmental groups have endorsed the use of fly ash in construction materials such as concrete and asphalt, saying they “are legitimate and safe reuses that should be encouraged.”²

²Testimony of Lisa Evans, Project Attorney, Earthjustice, before The Subcommittee On Energy And Mineral Resources, Committee On Natural Resources, U.S. House of Representatives, June 10, 2008.

►► Fly Ash Brick Lower CO₂, Energy Consumption



▲ Fly Ash Brick have good mortar adhesion.

Fly ash brick is hybrid technology... elementally similar to clay... hydrates similarly to cement

The manufacturer of FAB has tested the product with regard to heavy metal concerns, demonstrating that it is safe. It passes by a wide margin on EPA-

mandated tests for potentially hazardous materials – landfill simulation and rain-water (acid rain) leaching tests. Even a dermal (skin) exposure test – a test not required by regulatory agencies for construction materials – was performed “to be absolutely certain there is no concern with handling the fly ash brick” according to one company executive. It is a safe product.

Green Horizon

More sustainable solutions are coming online because there is demand. It comes from individuals, governments and building owners. Fly ash brick made in Wisconsin are a good example of an industrial business based on sustainability. They show that doing the “right thing” environmentally does not have to compromise aesthetics, performance or budgets if it’s approached with commitment and a sound business basis. That combination is the “win-win” for the future of construction. ■■■



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The green brick solution.



CalStar Products has reinvented masonry for the demands of green building.

Fly Ash Bricks from CalStar contain 40% post-industrial recycled material, use 85% less energy to make and generate 85% less CO₂ than traditional fired clay bricks and pavers. At the same time, they deliver the beautiful appearance, in-place performance and green benefits of traditional masonry construction.

Call us at 510-793-9500 or visit our website at calstarproducts.com to learn more and locate a dealer near you.



Pictured CalStar Holland Pavers in tan, natural and brown.