

### Innovations in Concrete

Numerous manufacturers of concrete-related products are trying to make this material stronger, more durable and more environmentally friendly.

*By Debra Wood*

Some newer concrete products, such as pervious pavement and self-consolidating mixes, have moved into mainstream construction, while other technologies are emerging or are in development.

One of the biggest current trends is the adoption of pervious concrete, which "has taken the country by storm," says Steve Kosmatka, vice president of research and technical services for the Portland Cement Association of Skokie, Ill. He says the use of pervious pavement can reduce or eliminate the need to create water-retention ponds for runoff because stormwater flows through the concrete.

Matt Sitter, director of marketing at the Florida Concrete & Products Association in Orlando, also reports an increase in the use of pervious concrete, and he says its application in Florida should grow if water management districts accept its use as a stormwater control option.

"Developers will save money if the water management folks give credit toward parking lots with pervious concrete," Sitter says. "The parking lot will be looked at as open ground."

**Self-consolidating concrete** Kosmatka says another product that has gained in popularity is self-consolidating concrete, which flows like water into place with little or no vibration, filling an entire void and surrounding reinforcing steel.

"It makes a clean, crisp surface, with clean edges," Kosmatka says. "You put less energy into the concrete if you don't have to vibrate it."

Polycarboxylate polymers and viscosity modifiers allow the concrete to spread into place by means of its own weight.

"You're dealing with the same strengths and durability," Kosmatka says. "It's just easier to work with."

Kosmatka estimates that about 40% of the precast plants use self-consolidating concrete, but now ready-mixed concrete users also are employing it. He says companies using it experience a savings in labor costs because it takes less effort to work with, and vibration noise is reduced.

**Self-cleaning concrete** Developed in Italy by the Italcementi Group, TXActive added to cement allows concrete to decompose organic and inorganic pollutants using ultraviolet light into harmless salts. HeidelbergCement in Germany, which produces the concrete, likens the process to photosynthesis of plants.

"It draws a lot of interest by architects and owners who want to keep their buildings really clean," Kosmatka says. "The manufacturer adds titanium dioxide to the cement, which is the same stuff in white latex paints. There's a reaction with pollutants, and it makes the surface clean."

**Waterproofing** Hycrete of Carlstadt, N.J., has developed and tested an admixture that integrally waterproofs concrete, eliminating the need for external membranes and reducing corrosion of the reinforcing steel. Hycrete's molecule chemically bonds to the cementitious materials and aggregates in concrete as well as steel. The company estimates contractors can save 20% to 60% compared to the cost of waterproofing.

“As soon as you pour the concrete, the waterproofing is done,” says David Rosenberg, founder and CEO of Hycrete.



*With pervious concrete, water flows through the concrete and into pervious site surfaces instead of running off impervious surfaces to stormwater sewers. (Image courtesy CTLGroup)*

Contractors have used Hycrete's admixture Hycrete Element™ in approximately 150 projects around the country, including a marina-pile project near Fort Myers, Fla. Hycrete warrants the product for 10 years. Nine locations in the United States and three international companies are using Hycrete.

“We're rapidly gaining adoption,” Rosenberg says.

Hycrete also makes it easier to reuse concrete because no petroleum-based external membranes, coatings and sheeting treatments are needed. Hycrete does not emit volatile organic compounds.

#### Greener mixes

Environmental sustainability

has driven other concrete modifications. QUIKRETE of Atlanta has created QUIKRETE Green Concrete Mix, which contains 50% recycled material and diverts aggregates, fly ash and slag from the waste stream.

Dennis Winchester, the company's executive vice president, reports in a written statement that the new green concrete mix offers similar setting properties and strength characteristics as more standard concrete mixes that use recycled materials. The material achieves a compressive strength of 3,500 psi in 28 days. The company indicates that the green mix qualifies for LEED points in the recycled content and regional material classifications. Initial marketing began in the Pacific Northwest.

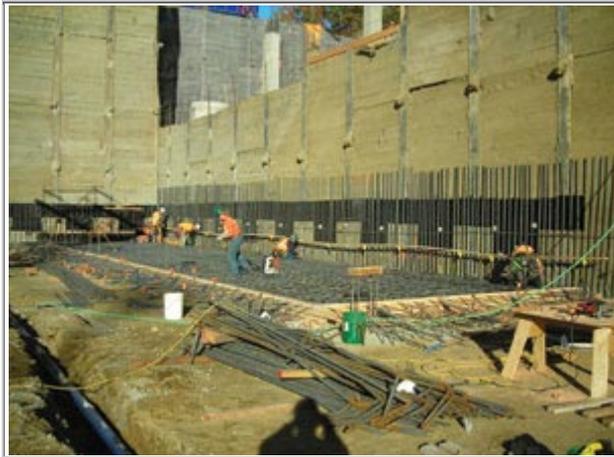
In the future, carbon dioxide emissions from energy plants could become a building material.

**“Calera's goal is to capture all of the CO<sub>2</sub> from coal-fired power plants and ... put it in the built environment.”**

— ANDY YOUNGS, CALERA

Calera Corp. of Los Gatos, Calif., has developed a supplementary cementitious material and aggregates for road base or concrete that combines seawater or another mineral-enriched water with carbon dioxide from electric, coal-burning power utilities, sequestering that pollutant and lowering the carbon footprint.

“We're mimicking what corals do naturally when they take CO<sub>2</sub> out of seawater and combine it with calcium to make coral skeletons,” says Andy Youngs, director of applications development and testing for Calera. “It makes a metastable polymorph.”



*By eliminating the need for external membranes, integral admixtures can enable a “pour-and-you’re-done” approach for a wide variety of applications, claims Hycrete, including slab-on-grade. An admixture manufactured by Hycrete also protects steel rebar from corrosion. (Image courtesy Hycrete)*

The crystal structure becomes stable in seawater and dissolves in fresh water, creating the cementitious material. The materials are designed to work well with Portland cement in concrete.

Calera is in the development stages. It has a pilot plant generating one to five tons of material for testing purposes. Youngs expects it will take about a year before the product is available commercially.

“Calera’s goal is to capture all of the CO<sub>2</sub> from all of the coal-fired power plants and take that CO<sub>2</sub> and put it in the built environment,”

Youngs says. “By producing aggregates, we’re able to find a beneficial reuse for the majority of power plant CO<sub>2</sub> in the U.S.”

**Higher strengths** iCrete of Beverly Hills, Calif., custom designs its concrete mix to minimize void space and maximize aggregates, thereby increasing its strength. Tishman Construction Corp. of New York used iCrete in the lower portions of 1 World Trade Center (Freedom Tower). The below-grade, sheer walls range from 4-ft, 10-in. thick to 6-ft, 6-in. thick.

Mike Mennella, Tishman executive vice president, told McGraw-Hill Construction, publisher of Southeast Construction, that the slag and fly ash help to lessen the heat on the large pours, allowing the work to proceed without the need for an extensive cooling system. Crews poured 600 cu yds to 700 cu yds per day, and the consistency of the product held throughout the day.

iCrete indicates it can increase workability and speed finishing times. And as with other newer concrete mixes, iCrete has a green appeal—it uses less cement than conventional concrete, which means less carbon dioxide is released during its production.

#### **Useful Sources:**

Portland Cement Association <http://www.cement.org/>  
Self-Consolidating Concrete <http://www.selfconsolidatingconcrete.org/>  
Pervious Concrete <http://www.perviouspavement.org/>  
Hycrete <http://www.hycrete.com/>