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# Blending of would-be landfill turns out greener cement-based products

**The vision of a greener future for the construction industry motivates Andrew Dennis, an architect from Las Vegas, Nevada, who founded a company dedicated to producing environmentally friendly cement-based products. This article describes how GigaCrete has made use of new technology to improve the environmental credibility of cement manufacture.**

Instead of the heavy aggregates found in standard concrete, the materials made by GigaCrete Inc. include non-silica based sands and by-products of coal combustion, fly-ash, bottom-ash and recycled glass that are usually dumped into landfills. The recycled materials are mixed with GigaCrete's own mineral cement formulation, which requires less water and yields less carbon dioxide ($CO_2$) in production than Portland cement, according to the company. In addition, GigaCrete claims that its materials are lighter and easier to handle than conventional cement based materials.

GigaCrete makes several cement-based building products that are packaged in 23kg bags and shipped in dry-powder form to users who mix them with water at construction sites. The bagged products include:

- PlasterMax IND; a one-step decorative interior plaster coating providing high strength and abrasion resistance when used as a protective finish over gypsum-based drywall;
- PlasterMax ICF; a two-coat interior plaster system replacing drywall, providing fire, abrasion and impact resistance;
- GigaFloor-IN; a stamped concrete overlay featuring fast installation, high compressive strength, and crack resistance;
- StuccoMax-ICF; an impact-resistant stucco product used as an exterior finish over insulated concrete forms.

In addition, GigaCrete makes a wet mixture used in the production of its PanelSystem construction product, which includes lightweight panels cast in GigaCrete's plant and delivered to job sites ready for installation. The system also includes patented steel connectors and components for door and window openings.

GigaCrete products comprise two parts cement binder and up to three parts filler, which can be sand of different grain sizes or ash of various grades. The products are typically made using 80% filler and 20% binder.

Each ingredient is supplied in 1361kg bulk bags and unloaded by one of five bulk bag dischargers to make a batch, depending on recipe. The dischargers are supported on load cells, which measure weight loss as flexible screw conveyors move material from hoppers below the dischargers, into a common, horizontal aeromechanical conveyor at ground-level. The material is fed into a vertically-oriented, 3.7m aeromechanical conveyor, which elevates the material before discharging it into a dry or wet mixer, depending on recipe.

**Right:** Andrew Dennis, chairman and founder of GigaCrete Inc., displays a bag of PlasterMax ICF building product, based on cement and recycled materials. In the background are a Munson rotary batch mixer (L) and continuous paddle blender (R).

## Blending the ingredients

Both the dry and wet mixers are loaded with a 907kg batch of binder and filler material, with water in the wet mixer adding an extra 20% to the weight of the charge. For dry blending operations, GigaCrete uses a 0.57m$^3$ Rotary Batch Mixer from Munson Machinery, consisting of a horizontal rotating drum with a stationary inlet and outlet at opposite ends. As the drum rotates, internal mixing flights and lifters tumble, fold, cut and turn the material in a multi-directional manner. The

**Right:** An operator fills a bag from the turbopacker below the rotary batch mixer.

**Far right:** A 0.57m³ rotary batch mixer (left) performs the dry blending of building products. To its right, a 2.8m³ continuous paddle blender prepares GigaCrete's wet PanelSystem construction product.


**Far right:** A powder transfer system, consisting of five bulk bag dischargers, prepares a batch, as aeromechanical conveyors transport material to one of the two mixers.

**Right:** From the rotary batch mixer, the blend discharges into a hopper and then into the turbopacker.

gravity-driven process produces a 100% uniform mix in just two minutes, regardless of the difference in bulk densities of the ingredients.

The lifters in the continuously rotating drum elevate the material, preventing segregation of the batch upon discharge through the stationary plug gate valve, as well as promoting total evacuation with no residual. The discharged blend falls through a 'pant leg' chute into a hopper and then into a turbopacker that can fill as many as four 23kg bags a minute.

For the wet panel mix, GigaCrete uses a 2.8m³ continuous paddle blender, also from Munson, consisting of a stationary mixing trough with rotating paddles that are driven through the material. The blender's horizontal shaft rotates inner and outer paddles with reversed pitches that move materials in opposing directions. A 2:1 agitator length:width ratio optimises mixing performance, agitating the material during loading, 10-minute blending of solids and liquids, as well as discharge. The paddle blender also carries out secondary duties as an additional dry mixer and has a mobile impeller bagging machine beneath the output valve for that application.

The blender's design limits its maximum mixing capacity to approximately 80% of the total vessel volume, leaving sufficient space for material flow on the upswing side of the agitator. This also allows the spray manifold to be properly distanced from the material bed surface, which ensures an even distribution of liquids added to mixtures.

Other key features include the stationary mixing trough's heavy-gauge walls and reinforced end panels, providing sufficient rigidity for tight agitator-to-vessel wall tolerances that minimise the 'heal' of residual material after discharge.

Wet concrete mixtures are gravity discharged from the paddle blender into a hopper, from which they are pumped 9-15m into mould boxes measuring 0.6m by 2.7m by 108mm. After a day of curing, the panels are removed from the mould boxes and are ready for shipment.

GigaCrete's goal for the plant is to produce 558,000m² of panels per year and 300,000 bags of dry material per eight-hour shift per year. These estimates were provided to Munson personnel, who used them to select mixing devices capable of meeting GigaCrete's output requirements. GigaCrete also provided Munson with material samples so that the supplier could observe how the different densities affected the equipment considered for the dry and wet applications. Other than its corporate office in Scottsdale, Arizona, and its GigaLabs plant and R&D centre in Las Vegas, Nevada, the company is expecting to open four more plants across the US.

"This is the pilot factory," Dennis says of the Las Vegas facility. "The goal is to refine the process here and then to use the final process in the next four plants."