Nick Barnett & Craig Hargis, Fortera

RECARB: SEQUESTRATION BY MINERALISATION

Fortera has developed a reduced-CO_2 solution that can reduce emissions by 75% compared to concrete made with ordinary Portland cement (OPC). Nick Barnett and Craig Hargis explain how it works.

Headquartered in San Jose, California, Fortera has developed a low-carbon concrete that can reduce emissions without the added costs of CO_2 sequestration. It operates a 15,000t/yr production facility in Redding, California, hosted by US-based producer CalPortland, owned by Taiheiyo Cement. The plant can mineralise 6600t/yr of CO_2 from the plant's kiln to manufacture its products.

Company profile

In 2007, California-based startup Calera pioneered this technology, but by 2015, had run into difficulties, ceasing operations. However, the technology laid the groundwork for a modified process when two former Calera employees, Mike Weiss and Ryan Gilliam, founded Fortera in 2019. They purchased the patents for the technology from Calera and re-hired key scientists to restart efforts.

Under Calera, the first pilot plant was commissioned in Moss Landing, California, in 2008. The first ReAct Blend commercial pour was in 2010 and construction of the demonstration facility was completed in 2012. The first ReAct Cement commercial product was launched in 2014. Under Fortera, the first small commercial plant was commissioned, in Redding, California, in 2024. Since 2025, it has been selling the product in California.

Fortera's production faciliity in Redding, California, US.

How it works

Fortera's technology uses limestone as the feedstock, which is calcined to form lime and CO_2. So far, so normal. However, the lime and CO_2 are then recombined to form vaterite, a reactive and unstable polymorph of calcium carbonate. The CO_2 is completely absorbed, thus eliminating the process emissions entirely. The result is a cementitious material with zero process emissions without the need for sequestration. Even if fossil fuels are used as a primary energy source, the CO_2 footprint is still substantially reduced.

In use, the vaterite dissolves and calcite, the most stable polymorph of calcium carbonate, is preferentially precipitated as a binder. It bonds well to substrates, like silica sand, gravel or reinforcing fibres.

There are two product lines: ReAct Blend is a vaterite-based material that is blended into traditional EN 197 / C595 cements or mixed into concrete during batching. The other is ReAct Cement, which is a hydraulic cement for full cement replacement. Both products are reactive calcium carbonates made from the ReCarb process, but have different specifications optimised for their respective product lines.

Emissions benefits

As of today, concrete made with ReAct Cement has embodied CO_2 emissions 75% lower than concrete made from OPC, based on the US national average of 919kg/t. With some small tweaks, such as product optimisation and electrification, the embodied emissions of ReAct Cement could be reduced from 230 kg/t down to 80 kg/t.. Through 'green' electrification, there is a clear path to 100% CO_2 reduction compared to OPC.

Use as a concrete

ReAct Cement is currently undergoing extensive testing as a material for concrete, following test methods laid out in ICC AC 529, as well as the ASTM C1157 performance requirements for hydraulic cement.

Use: ReAct is a general use cement, but it also has a low heat of hydration, high early-strength and high sulphate-resistance. This means that contractors with tight schedules, particularly in regions with high sulphate levels, can use the same mix across the board on any given project, greatly simplifying the build while reducing costs.

Concrete made with ReAct Cement is also tunable with admixtures. It naturally sets after 1.5hr, but it is possible to use low amounts of retarder to extend the set time. A moderate dose of retarder will produce the set times that contractors are used to, at around 5hr. High doses of retarder can also push that set time out to >16hr if necessary. The workability can be adjusted with water reducers. The same super plasticisers used at ready-mix plants can be used in the product, so full strength can be achieved in 1-2 days.

Strength: In concrete compression tests, the compressive strength reached 40MPa after two days, with strength stability through 12 months. The modulus rupture was 4.0MPa and the split tensile strength was 3.7MPa.

Shrinkage: Concrete made using ReAct Cement also has very low drying shrinkage. In the ASTM C157 concrete drying shrinkage test at four weeks, it achieved 0.002%. The shrinkage of a comparable OPC mix with the same strength and aggregate was 0.025%, 12 times higher after the same period. Reducing the shrinkage can reduce cracking and improve durability.

Colour: ReAct Cement has a bright white colour. It has a diffuse colour of 98.8 and a diffuse brightness of 96.7, which is higher on both counts than white cement (92.1 and 79.9 respectively). This means it's actually whiter than white cement, which comes in at two to three times the market price of OPC.

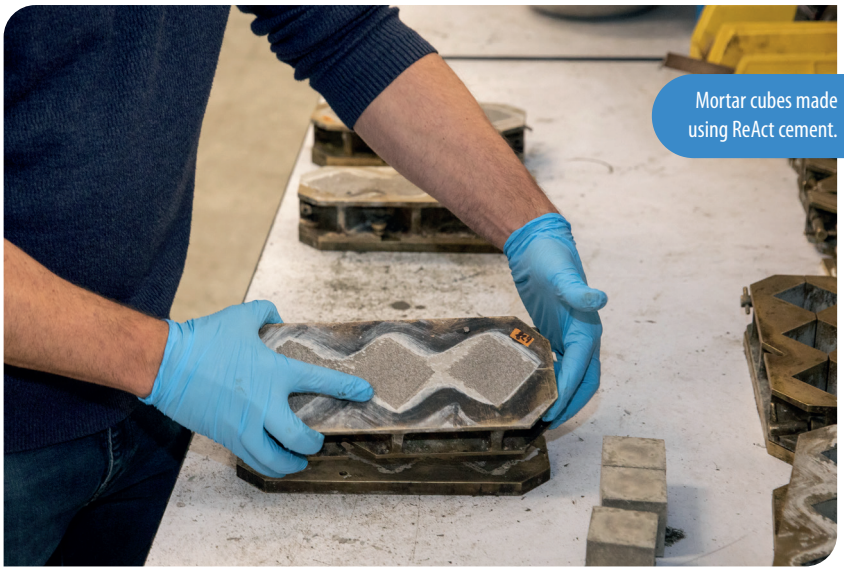
Future plans

In May 2026, Fortera conducted a field trial at one of its partners' ready-mix sites. The company learned a lot through this process, and it helped us to understand exactly what the contractor was dealing with by doing it ourselves at a larger scale.

Fortera is now exploring a number of ways to roll out its ReAct cement and concrete products, including through building its own plants and licensing the technology. We're open to any pathway that can build additional plants at pace. A significant final investment decision on a full-scale plant, with a ReAct Cement capacity of 0.3-0.5Mt/yr is expected by the end of 2026.

Conclusion

In summary, ReAct delivers a concrete with a faster strength gain, improved durability and a bright white colour, all at 75% lower CO_2 today, and with a pathway to 100%. We look forward to updating readers on the technology in the future.



Mortar cubes made using ReAct cement.