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Los Angeles Startup Uses AI To Reduce The Carbon Footprint Of Concrete

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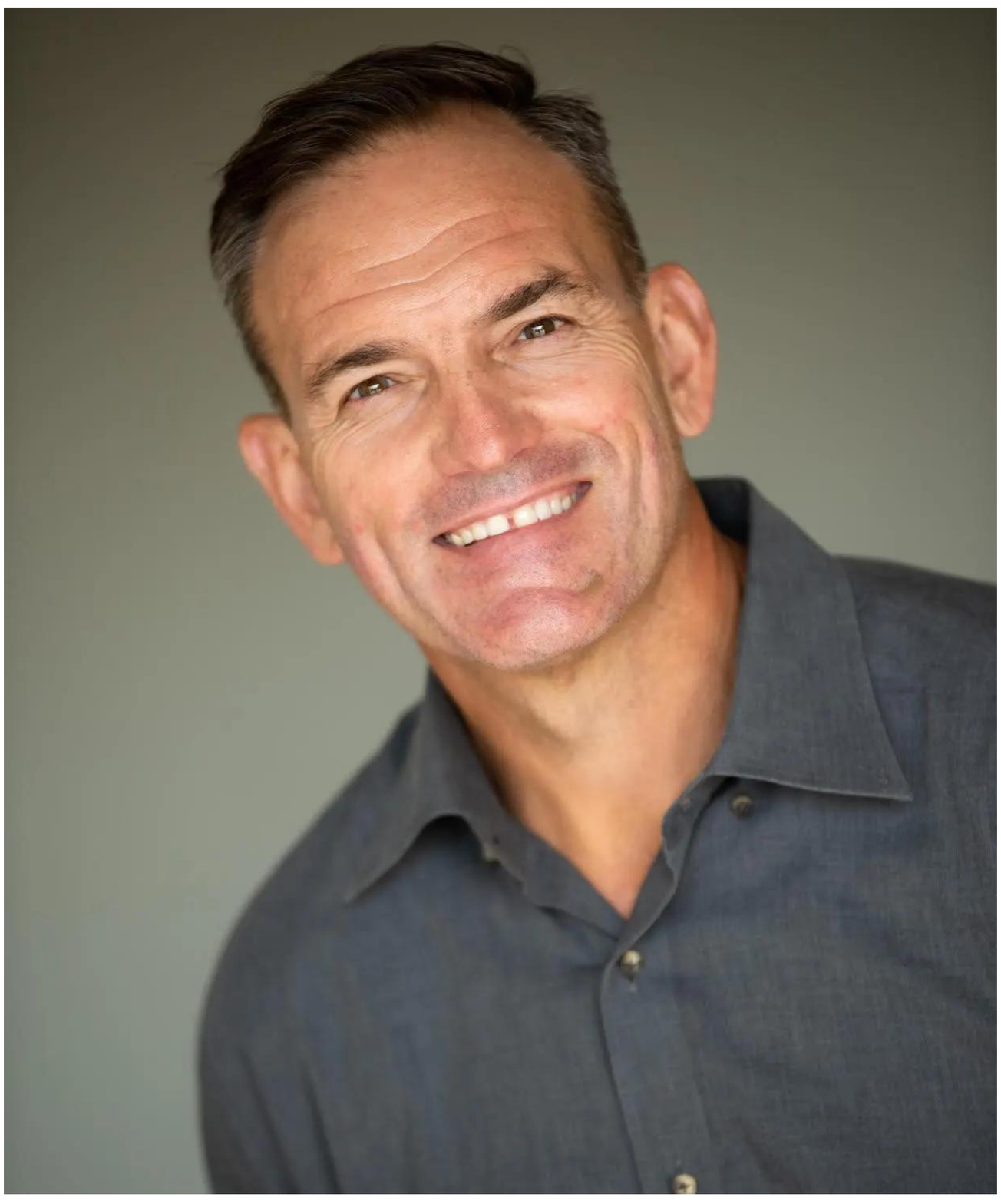

Concrete.ai CEO Alex Hall: “We haven’t seen technological advances in the concrete design and manufacturing world for the better part of 50 years.” CONCRETE.AI

For the past decade, researchers at UCLA's Institute for Carbon Management have been working on how to use data to reduce the environmental harm from concrete. Today, the startup based on their work, Concrete.ai, said that field tests using its AI-driven software reduced emissions by 30%, while cutting costs by more than $5 per cubic yard.

That's a big deal because cement, the key ingredient in concrete, is the source of 8% of the world's emissions of carbon dioxide, the gas that's catastrophically warming the planet. Yet concrete is ubiquitous – used in buildings, roads and other structures worldwide – because of its durability and low cost. Cement, whose main ingredient is typically crushed limestone, is a major producer of greenhouse gasses both because of the chemical reaction that creates it and because of the fossil fuels required to heat the kilns where it is produced. If you can use less cement in your concrete, while maintaining enough strength for the job, that translates to major carbon reduction.

"From an impact perspective, you're talking about three times more emissions than aviation," Concrete.ai CEO Alex Hall told *Forbes*. "We haven't seen technological advances in the concrete design and manufacturing world for the better part of 50 years."

While we may think of concrete as a basic commodity, it actually encompasses millions of possible formulations with varying structural differences. Different types of concrete use different amounts of cement, based on the strength needed. For instance, concrete that's used for building columns would typically require more cement than basic slabs of concrete. Los Angeles-based Concrete.ai is using generative AI to optimize different concrete mixes, telling concrete makers to swap in fly ash or slag for cement, for example, or alter the rocks or aggregates combined with it in order to use less cement. Its goal is to reduce the amount of cement required while still creating concrete that's strong enough for what it needs to do — lowering costs and reducing the material's environmental harm at the same time.

"Part of the modeling that has been patented allows us to run 3 to 4 million different iterations on a specific recipe," Hall said. "On the basis of what you are looking for, you select the optimal recipe. It is mass computation."

The startup plans to announce today at the World of Concrete event in Las Vegas that its technology, which it calls Concrete Copilot, is now available for commercial use. To date, the early-stage startup has lined up three commercial customers, and expects to sign on a fourth soon. Each customer represents multiple concrete plants, and Hall said he expected to be in 80 plants by year-end. He expects revenue to reach $1.5 million in 2024, up from just $250,000 last year. Hall said that Concrete.ai's ultimate hope is to reduce the annual global carbon footprint by some 500 million tons by optimizing concrete mixes.

> **"We have been working for more than 10 years on trying to understand how to use AI and machine learning to reinvent old traditional materials like concrete."**
>
> Mathieu Bauchy, UCLA associate professor and Concrete.ai cofounder

Fixing the problem of cement and concrete has attracted increasing attention from entrepreneurs and investors. University of Colorado spinout Prometheus Materials developed a process to turn algae into cement using a process that's similar to how coral and seashells naturally form. Terra LUNA 0.0% CO_2, backed by Bill Gates' Breakthrough Energy Ventures, has a different low-carbon alternative to cement, while Brimstone Energy, with funding from venture firm DCVC, is working to commercialize carbon-negative cement.

New regulations at both the federal and state level, including rules on government buying in the Inflation Reduction Act and a recently enacted "Buy Clean Concrete" program in New York state, are also nudging developers to look at lowering their carbon footprints.

Concrete.ai's researchers are also looking at other complex materials that could benefit from its AI-driven formulations to lower cost and reduce environmental harm. Hall said that the company's technology could also be used to help validate so-called "green cement" (a term for low-carbon alternatives, such as those being created by Prometheus and Brimstone) and other new materials.

In 2016, Hall, a longtime executive at Holcim, the Swiss building materials giant, saw an article with a photo of UCLA's Pritzker Professor of Sustainability Gaurav Sant holding up a vial of concrete and talking about how to turn CO2 into sustainable concrete. "I thought, 'This is the future, I've got to get involved with these guys,'" he said. In 2017, while working at Suffolk Construction, Hall, 52, became an advisory board member to CarbonBuilt, a separate UCLA spinout that embeds CO2 emissions into ultra-low carbon concrete.

Meanwhile, Mathieu Bauchy, a 38-year-old computational materials scientist who is an associate professor at UCLA, was working on the model that underpins Concrete.ai. "We have been working for more than 10 years on trying to understand how to use AI and machine learning to reinvent old traditional materials like concrete," he said. "This is just a data problem."

In 2021, Bauchy (who also serves as the company's chief technology officer) and Sant spun out that research into Concrete.ai. Hall joined as CEO that September. The company has raised a total of $3 million, and is looking to raise an additional $2 million to expand its research and development.

For the past three years, Concrete.ai has been testing its models in conjunction with concrete producers across the United States. It has optimized the mixes used in more than 2 million cubic yards of concrete—enough to fill 681 Olympic-sized swimming pools. The company said that it had saved an average of $5.04 per cubic yard, while achieving an average carbon reduction of 30%, by optimizing mixes to decrease the amount of cement needed. Hall said that he was "100% shocked" by those results.

Chris Rapp, vice president and general manager at VCNA Prairie Materials, a subsidiary of Brazilian cement giant Votorantim Cimentos with operations in Illinois, Indiana and Michigan, started working with Concrete.ai for its early field tests. "Over the past four or five years, we've seen the market become more aware of the carbon footprint of these buildings," he said. "As they [developers] are becoming more aware of their carbon footprint, they are putting more pressure on us to solve that."

At first, Rapp said, the company was doing its own R&D and looking for alternative products. Then, a few years ago, Prairie, which has 25 plants in the midwest, connected with Concrete.ai and started testing the tool. For its size, he said, it was a better solution than alternatives. "We are such huge consumers of materials that we need something that is scalable," he said.

Today, Prairie has rolled out Concrete.ai in around half of its factories. It's now being used to optimize the materials of a big industrial warehouse project that Rapp expects will require 20,000 to 30,000 cubic yards of concrete. A concrete truck, for comparison, carries just eight cubic yards at a time.

"As of now, there is no other material that can meet the scale of concrete—it's like one ton of concrete per person that we produce every year," Bauchy said. "At some point we have to decide: Do we want to build new things and repair the infrastructure that we have? And if we want that, we have to continue to work with cement and figure out how to use it more efficiently."