

Your next house could be built by a giant robot

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Credit: Pixabay/CC0 Public Domain

Hugo and Erica Briones, like thousands of other homebuyers in North Texas, are waiting patiently for their new home to be built—but their home is different.

Unlike most of the 48,000-plus new homes that began construction in Dallas-Fort Worth last year, the Briones' 1,700-square-foot, three-bedroom, two-bathroom house is one of only a few in the region built using a new method of construction, concrete 3D printing.

A handful of builders across Texas, large and small, are using giant automated machines to "print" homes, layer by layer, within weeks if not days. The "3D printers" control nozzles spouting concrete mix based on programmed coordinates, similar to a desktop 3D [printer](#) but at a much larger scale. They only require a small crew to operate.

"We decided to look around and compare prices, and we figured out that a conventional house is way more expensive than doing it this way," Erica said.

Builders and other experts in the local housing market say the technology could help avert labor shortages and supply issues and provide more affordable homes than traditionally built homes.

"In the race to satisfy the demand [for affordable housing], the quality of construction is going down," said Sebin Joseph, [chief technology officer](#) and co-founder of Dallas startup Von Perry, which is printing a home for the Brioneses. "The only way you can remedy that situation is by implementing automatic construction, which is far faster and superior than conventional construction."

Phil Crone, executive director of the Dallas Builders Association, said he could see 3D-printed homes become a much more substantial part of the market in 15 to 20 years as technology advances and labor issues continue.

"There's every market incentive in the world for the built environment to find less labor-intensive options that don't involve just a traditional stick-

frame, lumber-centric framing process that we've done for hundreds of years," Crone said. "It's not surprising to see 3D printing jump into that arena."

The space is rapidly evolving. In Houston, Germany-based Peri 3D Construction and Houston-based engineering firm Cive are building what is believed to be the country's first 3D-printed home with two floors, NPR reported.

Still, 3D home printing is far from ready to be deployed at a scale that would rival lumber-built homes. Very few printers are available for builders to use and the process itself has not yet been perfected.

"It's certainly got a ways to go before it can build at the intricacy needed for most of today's modern home plans," Crone said. "I don't foresee it being the majority of homes anytime soon, but it is definitely a technology to watch."

Cutting costs

The Brioneses sold their house in Plano about two years ago hoping to build a new home for the first time. They already had a spot in mind next to Erica's parents' home in the small town of Nevada in Collin County, which they saw as a quieter, calmer place to raise their family.

The family looked around for traditional builders to compare costs, but they found them to be too expensive. Then, about a year ago, Erica's brother Gerardo Alvarez, an architectural student at the University of Texas at Arlington, introduced them to a young entrepreneur he works as a designer who had a solution.

Treyvon Perry, 22, had dropped out of UT Arlington at the end of 2021 to focus on Von Perry, a company he started when he was just 17 years

old. The company originally centered around designing homes using different types of sustainable materials, but later realized the cost to actually build those homes would be too high.

In 2020, Perry started researching 3D printing and decided to fully adopt the technology to build homes while also exploring the use of sustainable materials in the process.

"When people think of Von Perry, they think of us just as a 3D-printing company," Perry said. "Well, no, that's not really our mission. Our goal is to produce sustainable infrastructure and bring it to the mass market at an affordable price."

The Briones family started talking to Perry about how much more affordable, efficient and resistant to the Texas weather the home would be. For the Brioneses, the 3D-printed home cost about \$200,000, while a smaller traditionally built home would have cost more than \$300,000. The family also looked at mobile homes, but decided the concrete-printed home would be a much better deal.

Printing kicked off in November. Hugo, a machine operator in McKinney, said he has been telling his coworkers about the home, and that they are already interested in visiting the house and even wanting to submit an application to build their own. The Brioneses' home will be fully complete in March.

"All the people that I talk to about the home, they like the idea and the price and everything," he said.

Von Perry has two other projects in the design phase as it continues to experiment with the technology. The company is looking into using recycled plastic for interior walls and printing using different materials than simple cement in the future.

Perry was originally looking into manufacturing the machines, but decided that would be too costly and time-intensive and chose to focus on buying printers made by others and act essentially as a project manager. The company is currently using a printer made by Minnesota firm Total Kustom.

But relying on third parties for the printers presents another challenge, the extraordinarily small number of them available in the country, which Joseph says is "probably less than 10." That, in addition to weather, led to delays in printing their first house for the Brioneses.

"We got a lot of rainy days and very cold days when the mix wasn't working very well on, because that the printing should be in an optimal temperature," Joseph said. "So we had to figure out all those things."

Out by the lake

In Mabank, a small town along Cedar Creek Lake southeast of Dallas that has seen an influx of builders looking to build affordable homes, another small business called MRB Robotics has already completed two 3D-printed homes.

The company's founder, Craig Pettit, previously worked in data processing and has been fixing and flipping homes as a side gig for more than a decade. While looking into building new homes in late 2020, a friend sent him an email about the concept of 3D concrete printing.

"I felt like with my computer science and construction background, I'd be in a unique position to get a [head start](#) on the new technology," he said.

Pettit's printer is a prototype he bought from another manufacturer and has since modified. Even with it being new technology, he said he

expected the printer to work right out of the box like a paper printer but found that many different factors from structural to mechanical to weather can get in the way. It takes practice to perfect the process, he says.

"The trick is that the speed of the printer has to match the speed of the pump," Pettit said. "If the printer is moving faster than the pump, the wall will be too thin. If the printer is moving slower than the pump, the wall will be too thick."

Pettit started printing his first three-bedroom house in Mabank in November 2021 and got to work on another home the following month. The first home took 10 days to print, and the second took just six days, followed by four to five months for a general contractor to finish them with a roof, utilities, windows and doors.

A resident started leasing the second house about two to three months ago, and the first is on the market for \$1,500 per month, said Pettit.

Now, Pettit is finishing a 14-unit self-storage facility just outside of Mabank in Payne Springs, which he started working on in August 2022. While factors such as rain and stopping to make some engineering changes created some delay, he said that in ideal conditions he could have printed the facility in a week.

Pettit plans to continue printing houses and self-storage facilities and is looking into a project to build a "retail village" in Highland Village that could start as soon as the third quarter of this year.

He also plans to start another home in Mabank in February, and by the end of 2023, he expects to begin selling his own machines to small- to mid-sized homebuilders that he says "will be as easy as opening a box and printing a house."

Pettit said that because 3D printers can form houses in any shape, designs are possible that would be very costly using traditional construction methods—like a 25-foot wave wall with vase-like contours he printed as part of the storage project. He says his homes are also more resistant to floods, wind, termites, mold, fire, noise and heat.

Thinking big

One of the earliest and biggest players in the 3D building-printing space was Austin-based Icon that has raised \$451 million since its inception in 2017.

The company has printed 3D homes and structures across the U.S. and Mexico, from market-rate homes to disaster-relief housing, military barracks and homes for the homeless. Icon even has contracts with NASA to build research and develop construction systems for infrastructure on the moon.

"We've really got to fundamentally be reimagining what is possible in a future with machines that can work around the clock," said Dmitri Julius, Icon's chief of special projects. "Yes, we've got a consumer housing problem, but we also have this broader global housing crisis that's impacting humanity, and I don't think any of us are comfortable with the current solutions."

In November, Icon and publicly traded homebuilder Lennar said they had begun construction of a community of 100 3D-printed homes within the Wolf Ranch master-planned community in Georgetown, a suburb of Austin, using a fleet of their Vulcan 3D printers.

"For us, this represents the beginning," Julius said. "Houses by the thousands and tens of thousands is what we believe these printers will be able to deliver in the future."

Lennar developed the land and handled the foundation for the homes. Icon's 3D printers, using a proprietary concrete mix called Lavacrete and controlled by an iPhone or iPad app, will deliver all the home's walls. Lennar's traditional trade partners will then install a roof, finish out the interiors, deliver appliances, install electrical systems and do the landscaping.

Each is co-designed by the Bjarke Ingels Group, which is based out of Denmark and New York City. The three- and four-bedroom homes range from about 1,600 to 2,100 square feet of living space and will start in the mid-\$400,000s—around the same price as nearby traditionally built homes. Reservations begin this year.

"The fit, finish and fixtures in these homes are going to be equal to if not better than the houses that you're used to seeing in your normal, everyday master-planned community," Julius said. "These are ready for primetime."

Charlie Coleman, Austin division president for Lennar, said he first met Icon founders Evan and Jason Ballard just over two years ago after seeing them present 3D-printed tiny homes at the South by Southwest conference in Austin.

Coleman said the technology could help the company build high-quality homes more affordably and more efficiently with fewer workers on site.

"I think this could really help by introducing some technology to help fill in a gap where we just don't have enough of our trade partners and our labor to build, certainly in our market," he said.

Balda, who has led Dallas-based Hillwood Communities for more than 30 years, said he was quick to jump on board when Lennar approached his company with the idea of working with Icon in their Wolf Ranch

neighborhood, seeing it as a solution to the supply chain and labor challenges that have ravaged the industry.

"The last couple of years and homebuilding has been horrendous for many reasons," he said. "We thought this technology might help address some of those issues that we're all seeing."

Balda said the concept of concrete homes made by a giant printer wasn't too far off from homes already built on concrete cinder blocks in Florida to withstand hurricanes, making it easy for him to digest the idea. The development veteran said he hopes to bring 3D-printed homes to other communities in North Texas, but is not in talks to do so quite yet.

"We need all these different ideas to come to the marketplace to help address the supply issue that we're currently dealing with."

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