

3D PRINTING

# Discarded glass used to replace sand in 3D-printable concrete

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*A 3D-printed bench, made of concrete in which ground glass was used in place of sand* Nanyang Technological University

Concrete is a very popular building material, enough so that one of its key ingredients – sand – is in increasingly short supply. Scientists are thus now exploring the possibility of replacing that sand with glass waste that would otherwise end up in landfills.

Although glass is considered a recyclable material, it quite often doesn't *get* recycled. This may be due to a lack of properly equipped recycling facilities, or the fact that glass waste

frequently takes the form of numerous fragments that are too small to sort by color in a practical fashion – that sorting process is a requirement for recycling.

Seeking a use for non-recycled glass, researchers at Singapore's Nanyang Technological University looked into utilizing it as a replacement for the sand commonly used in 3D-printed concrete structures. After all, glass is made of silica, which is a major component of sand.

For their study, the scientists crushed glass waste into five different fragment sizes – coarse, medium, fine, super fine and "moondust" – to replace the sand and gravel which ordinarily serve as aggregate in concrete. That ground glass was then combined with concrete's other two ingredients, cement and water.

The mixture was subsequently extruded through the nozzle of an existing 4-axis gantry robotic 3D printer, to create a 40-cm tall (15.8-in) L-shaped concrete bench. Once the concrete cured, it was found to be similar in strength to traditional sand-containing concrete. Additionally, the researchers noted that the poured concrete didn't deform or collapse before it cured, plus it was fluid enough to flow easily through the printer nozzle.

As an added benefit, because glass doesn't absorb as much water as sand, less water was required to make the concrete.

"Our research has shown that recycled glass can be used to replace up to 100 percent of the sand in concrete for 3D printing," said the lead scientist, Andrew Ting. "The result is a concrete bench with a mechanical strength that meets acceptable industrial standards. Given that sand is being exploited at a rate much quicker than it can be replenished naturally, the prospect of using recycled glass in building and construction is becoming more attractive."

The research is described in a paper that was recently published in the *Journal of Building*



NEW ATLAS



A [2019 study](#), conducted by scientists from Australia's Deakin University, indicated that glass could also replace sand in more traditional non-3D-printed structures.

Source: [Nanyang Technological University](#)