



## Innovating with 3D-printed building materials

---

Three-dimensional (3D) printing an entire building is not as far-fetched as it might have once seemed. PhD graduate and BRANZ scholarship recipient Armano Papageorge of Victoria University of Wellington has developed a solution to streamline the 3D printing of building parts. These findings aim to drive greater efficiencies in building design and construction.

Innovative technology is a catalyst for new and improved ways of working. However, as innovation comes with economic risk and liability issues, the speed of change within the building and construction industry remains slow. Research that proves the effectiveness and reduces uncertainty of modern technologies can help drive uptake and efficiency gains.

In Aotearoa New Zealand, research and development has focused on off-site prefabrication of timber construction systems and concrete precast elements. However, overseas 3D printing is at the forefront of research, with promising results. Construction components can be printed out of a variety of materials such as plastic, resins, metals and concrete and include cladding, structural panels and columns.

With funding from the BRANZ scholarship programme, 3D-printing pioneer Armano Papageorge created and tested a computer-aided design (CAD) workflow to generate 3D-printable construction components.

A current challenge with 3D printing for construction is that each phase of a project requires a different CAD software package and transferring data between them results in information loss. Armano designed an integrated computerised workflow to successfully generate 3D-printable products.

To prove it worked, he produced two different construction components – a concrete masonry unit and a precast concrete wall panel. He showed that alterations could be made efficiently and quickly to achieve a range of different architectural aesthetics such as different shapes, sizes and textures.

Armano's research shows the potential of computational design in improving common yet inefficient processes within the briefing, design, documentation and construction of buildings. The role of 3D printing for the mass manufacture of easily customisable building components looks promising.

By awarding funding to innovative research, BRANZ is investing in new technologies to help solve issues facing our society such as housing shortages and affordability. Both these Industry 4.0 technologies – CAD and 3D printing – have a role to play in transforming the building system for the future.

## IN THEIR WORDS



### Armano Papageorge, PhD graduate, Victoria University of Wellington

#### What sparked your interest in 3D printing for construction?

My passion for computational construction 3D printing began in 2017 with my master's thesis. During my initial research, I discovered just how powerful the combination of computational design, robotics and 3D printing could be for the construction industry. That's why I decided, there and then, to commit my career to digital and manufacturing innovation within architecture and construction.

#### Why do you think 3D printing is so transformational?

The ability to automate 3D printing is what makes the innovation so impactful. You can create complex structures with high levels of precision at almost no additional cost. The technology can also save time, reduce waste and improve on-site and off-site health and safety.

#### What does the future hold for 3D printing?

Even during my PhD years, there has been exponential growth in construction 3D printing – most typically overseas but there are some interesting new projects developing in New Zealand too. Within the next 5-10 years, I think this construction technology will only continue to grow, especially with the growth of artificial intelligence making big moves across the globe.

#### What has being part of the BRANZ scholarship programme meant to you?

Receiving funding from the BRANZ scholarship programme was incredibly helpful. I am very grateful to BRANZ and the people who I've had the pleasure of working with.

#### What's next now that you have finished your PhD project?

I have dived straight into the workforce as the BIM lead for a quantity surveying company. I also perform some computational BIM consultancy for a high-end residential architecture firm. I'm embarking on my own 3D printing business, which will be up and running in a couple of months.

**I am very grateful to BRANZ and the people who I've had the pleasure of working with.**

#### About the BRANZ scholarship programme

Every year, BRANZ awards Building Research Levy funding to outstanding postgraduate scholars in tertiary institutions. The BRANZ scholarship programme is part of our portfolio of investments to support innovative research and the next generation of research talent.

Read more at [branz.co.nz/investing-research/building-research-scholarships](https://branz.co.nz/investing-research/building-research-scholarships)