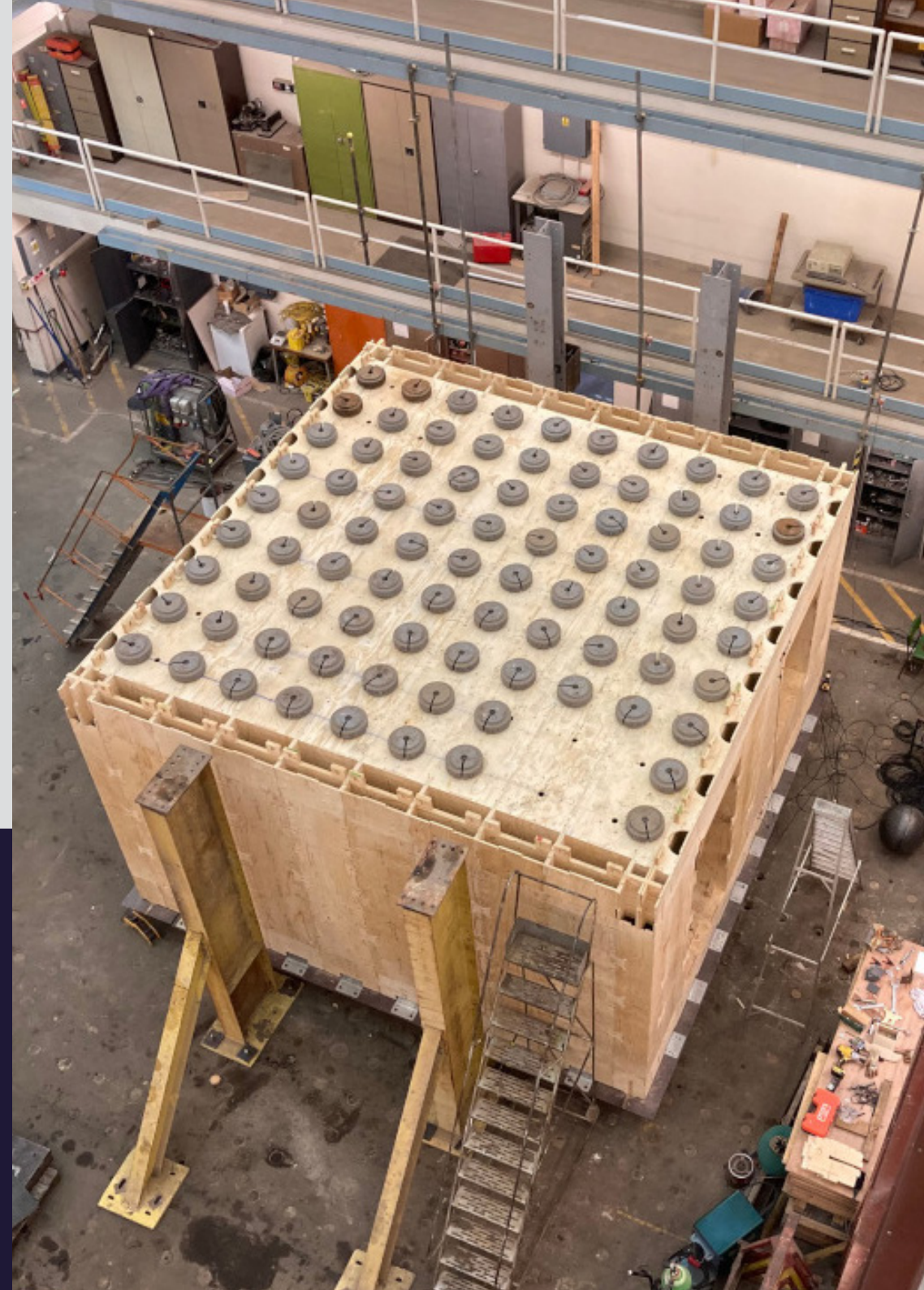




CASE STUDY

Open Systems Lab identify development opportunities through BRE structural testing

Following initial work with the University of Edinburgh, Open Systems Lab commissioned BRE to undertake large-scale structural testing of their latest project. Successful testing validated performance, providing confidence during the pre-commercial prototyping process and identifying improvements and areas for further development.



Challenge

Non-profit research and development lab Open Systems Lab is working on open digital innovation to tackle systemic social, economic and environmental challenges.

WikiHouse, a digitally manufactured building system, is an ongoing experiment into the intersection of sustainable construction, digital fabrication, and online open-source communities. Unlike other modular approaches which require a large factory, WikiHouse can be manufactured by a distributed network of small, local microfactories using digital fabrication tools.

Independent testing was necessary as part of the pre-commercial prototyping process. Initial work was done with the University of Edinburgh to develop the

structural testing procedures and conduct small scale experimental lab tests.

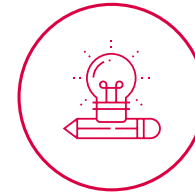
A lack of empirical knowledge and related research of the behaviour of CNC machined timber structures, particularly regarding timber-to-timber connections, meant that large-scale testing facilities were required to understand how this construction method performed as a whole interdependent system. This knowledge is particularly crucial, as Clayton Prest, commenting on behalf of Open Systems Lab, explains *"Not having this knowledge would lead to lower adoption and less interest from designers, engineers, and insurers, and a longer lead time for design and delivery that would make this product unfeasible and uncompetitive with other offerings in the DfMA market"*.

Benefits



Performance

Independent verification validated product performance



Understanding

Improved product understanding during the pre-commercial prototyping process



Knowledge

Led to the production of reports and academic articles to further hollow-core CNC timber structures knowledge

What was done

Open Systems Lab commissioned BRE to undertake a programme of large-scale structural testing based on BRE's long-standing reputation with timber and modular innovations, and the expertise of BRE's testing experts.

Testing took place at BRE's dedicated testing facility, by technicians with extensive knowledge and experience of structural testing, over three weeks from May to June 2021. The test programme covered two types of testing: racking strength and stiffness of two-dimensional panel and a three-dimensional module test. Prior to the test programme with BRE, testing and prototyping had only been carried out on individual 'blocks' and connections, but Open Systems Lab were keen to understand how these 'blocks' would perform as a whole connected system.

BRE's technicians carried out a range of racking tests on 5.4m wall sections: horizontal load without openings; horizontal and vertical load without openings; horizontal load with openings; horizontal and vertical load with openings. These 2D wall tests were followed by combined vertical and horizontal load testing of a 3D volumetric module.

Project outcome

Open Systems Lab were keen to validate the performance of the product against Eurocode/BS standards for timber structures, while identifying improvements and areas for further development. Open Systems Lab are pleased with the successful testing programme which has provided independent verification of the effectiveness of the product. It has also provided a structure for Open Systems Lab to work with University of Edinburgh, supported by BRE experts, to produce two reports and academic journal articles to further knowledge in the field of hollow-core CNC timber structures.

Next steps

BRE has been a trusted resource throughout the testing period and Open Systems Lab wish to build on this strong working relationship through continued structural testing. As an organisation, they anticipate further rounds of testing as they develop new subassemblies as part of their Skylark product range, and validate improvements to the design of existing elements. They are looking forward to continuing the collaboration with BRE.



About Open Systems Lab

Open Systems Lab is a non-profit R&D lab working on open digital innovation to tackle systemic social, economic and environmental challenges. We are currently working to redesign the systems that shape the places where we live.

We work with private, public and third sector organisations, and with citizens, to design and deploy 21st century systems that work for everyone.



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About BRE

BRE delivers innovative and rigorous products, services, standards and qualifications which are used around the globe to make buildings better for people and for the environment. For a century we have provided government and industry with cutting edge research and testing to make buildings safer and more sustainable. BRE's ambition is to be the world's leading innovation, science and data hub for the built environment. By developing science-led solutions to urgent challenges, we will build a thriving and sustainable world.



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// With the support of BRE's world-class engineering expertise and facilities, this has been a watershed moment in the development of WikiHouse - a tested, validated, zero-carbon construction system that anyone can use. We are grateful for the dedication and technical problem-solving of the BRE team, in collaboration with the University of Edinburgh researchers, to enable us to test and analyse the behaviour of these innovative, digitally-fabricated timber structures, and make this knowledge available to everyone to improve on. //

Clayton Prest, Research and Development (R&D)
Lead, Open Systems Lab