DYSON STUDENT VILLAGE

General information

The Dyson Institute of Engineering and Technology student village was designed by WilkinsonEyre and manufactured and assembled by Carbon Dynamic. The site can accommodate up to 50 students together with visiting staff and includes a communal space with a library, café, bar, and screening room.

The development was constructed using volumetric CLT units, completely manufactured offsite and rapidly assembled on site. Edinburgh Napier University's Centre for Offsite Construction and Innovative Structures (COCIS) participated in the project and carried out structural design and testing.

LOCATION	Malmesbury, Wiltshire, England
YEAR	2018
PARTNERS	WilkinsonEyre, Carbon Dynamic, Edinburgh Napier University (ENU), Design Engineering Workshop, Binderholz, Stora Enso

Dyson Student Village (image by Peter Landers Photography)

Project description

The student village is constituted by 78 volumetric units, variously assembled to form 19 clusters up to 3-storey high.

Each cluster includes a shared kitchen and laundry and an entry area with reception and storage. Each pod has its own access, either directly from the garden or by earth ramps and stairs. The accommodations include a toilet and shower room, and an open-plan bedroom area and work/living space; the units were delivered to site fully-fitted with bespoke furniture and built-in storage.

The buildings are constituted of 92% natural materials and each unit is provided with triple-glazed windows and natural ventilation.

Carbon Dynamic took a fabric-first approach and applied Passivhaus principles to design. "A Passivhaus is a building in which thermal comfort can be achieved solely by post-heating or post-cooling the fresh air flow required for good indoor air quality, without the need for additional recirculation of air[1]"; heat sources are, therefore, the sun, occupants and household appliances; additional heat can be supplied up to 10W per square metre[2].

[1] *'The Passivhaus standard', Passivhaus Institut*
[2] *'What is Passivhaus?', Passive House Trust, 2018*

Timber system

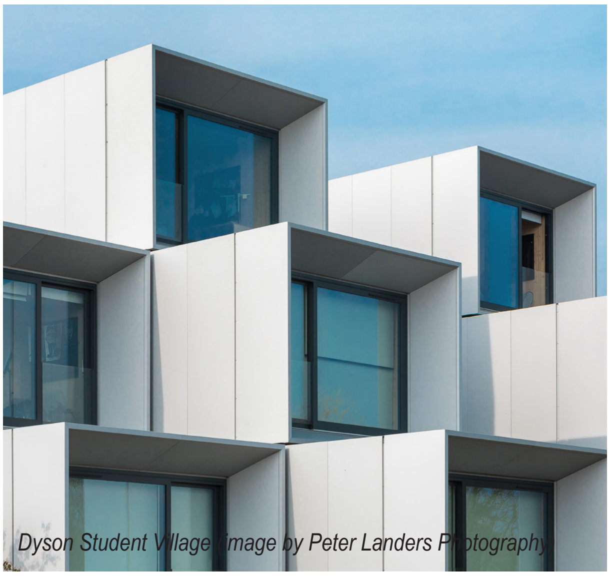
For this project Carbon Dynamic designed, manufactured and assembled volumetric units made of Cross Laminated Timber (CLT) imported from Europe. The modules are 7.2m x 4.2m x 2.9m and can be assembled cantilevered up to 3 meters.

The project was developed using two sets of prototypes for the client, a design prototype and a structural prototype. The design prototype included interior finishes, furniture, electrical access points and cladding and was used for the client's review; it was also useful to finalise the module's weight and exact size.

A technical prototype was used to assess the structural properties of the modules and verify the assembly process, the connection to the ground and the accuracy of the system. Due to standard load width restrictions for transportation, the external aluminium cladding was installed on site in a dedicated buffer zone.

A key element for the successful delivery of the project was the early design and engagement with the supply chain. Every aspect of the modules, from CLT connections to the position of power sockets, had to be finalised before manufacturing could start.

In addition, although the modules look identical, there are small variations in their structural and design properties. To manage the variation between the modules, the engineer used a design interface matrix, in which every cluster was classified according to its structural connections to control the balance between replicability and customisation.



Dyson Student Village (image by Peter Landers Photography)

Research focus

Structural performance for innovative design

The presence of cantilevered modules required the study of specific engineering solutions, especially for the connections between units. A new connection was designed for the Dyson Student Village, which consists of a steel plate bolted to the modules from the inside.

Dyson Student Village (image by Peter Landers Photography)

In this respect, the construction of the technical prototype was particularly useful given that it allowed verifying the predictability and accuracy of the new connections.

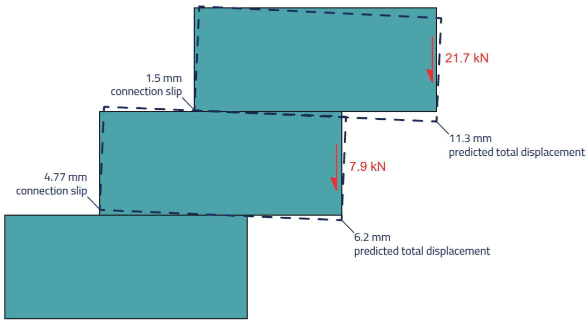
The prototype was also used to carry out tests on the static load, vibration and acoustic properties of the structure. In particular, the deflection of the stacked modules was calculated and then tested under a static load applied by a testing rig.

The calculation method was based upon BS EN 380:1993 and considered as total displacement a result of the combination of elements deflection and connections slip. According to the calculation, the total displacement of the modules under static load (based on 2 kPa floor loading) was expected to be 11.3 mm; the result given by the test was better than predicted, with only 8.3 mm displacement.

When the loads were released, the system went back to its original state demonstrating both the robustness and the flexibility of the engineered volumetric system.

Key findings

- Modular systems are ideally suited for student accommodation or other projects with high repeatability of design elements.
- The re-location, re-use and refurbishment potential of the modules contribute to the resilience of the project aligned with the principles of circular economy.
- The use of a design interface matrix, in which every cluster was classified according to its structural connections, was key to control the balance between replicability and customisation.



Displacement test scheme (image by Andrew Livingstone)