2020 CONCRETE SOCIETY AWARDS

Highly Commended

Town House at Kingston University, Kingston upon Thames

Town House is a stunning six-storey mixed-use learning and teaching building formed from an environmentally friendly structural concrete frame. A series of interlocking, open-plan volumes are enveloped by a façade including colonnades on three sides, all with extensive exposed internal and external concrete finishes. The design encourages collaboration and exchange between visitors.

Above: Auditorium. *(Photo: Ed Reeve.)*

Town House is a six-storey building with three floors of library, study rooms and informal learning spaces, dance studios and covered courtyard/assembly space, providing much-needed high-quality spaces for the university's students, staff and visitors. The whole project team worked in close collaboration to deliver a signature building in line with the architect's vision. The design imagines a place where reading, dance, performance, lectures, exhibitions, research and learning happily co-exist under one roof and where the front door is open to all. The architecture reflects this openness with colonnades, which form welcoming meeting spaces at edges. Interlocking volumes move vertically, connecting the building from ground to top.

The goal was to deliver a wholly sustainable building, which incorporates exposed structures along with an inherently flexible interior with long-spans of 10–15m, as well as a series of double- and triple-height spaces.

Realising this unique design required an equally unique structural response. Bespoke prestressed double 'T' units were used for the main flooring system, minimising the amount of concrete necessary for these long spans, while maximising the surface area and hence optimising thermal radiance to the benefit of the energy strategy for the building. Cement replacements within the concretes further reduced embodied CO_2 within the building. Cooling pipes were attached to the top flange of the units and cast within the structural topping screed, allowing active thermal interaction with the floor introduced via the floor void. The repetitive nature of the ribbed floor, the most prolific structural element, made precasting a natural solution for the structure of the project.

The grand staircases within the atrium are a key feature of the design. Tuned mass dampers were used within their construction to allow the lightness of the design to be maintained, while providing appropriate vibration performance.

Grafton and AKT II developed their designs in close collaboration with subcontractor PCE, ensuring that buildability was embedded within the details of the design that was developed for construction; this included all of the high-quality exposed architectural concrete of the colonnades and mullions. In all, there are over 200 precast double T units, 300 beam and column sections, and 175 architectural mullions as well as solid precast core walls.

A fully co-ordinated building information management (BIM) method to Level II protocols was adopted by all parties, with special emphasis being placed on pursuing a design for manufacture and assembly (DfMA) approach to enable certainty of on-site delivery, while achieving the

architect's vision for concrete excellence.

By manufacturing the majority of the structural frame in precast concrete off-site under quality-controlled factory conditions, with deliveries to site for construction being managed logistically on a 'just in time' basis, not only were the high-quality requirements uniformly maintained during a production process unaffected by climatic conditions but also significant environmental benefits were achieved, including reducing the volume of waste on- and off-site and the overall on-site period.

The project site was constrained by adjacent university buildings, which remained operational during the construction period, the busy Penrhyn Road and an adjacent residential street. By using a hybrid concrete frame approach, primarily a combination of precast and in-situ concrete, delivery vehicle movements were minimised, as was the number of personnel required to construct the building, leading to a reduction in disturbance and noise nuisance for the university and its students and neighbours, a lower construction CO_2 footprint and significantly reduced health and safety risks.

The internal structure is formed from reinforced precast concrete columns, beams, walls, volumetric liftcore modules and stair units, with prestressed precast double-tee and hollowcore flooring units manufactured at three different factories. Over 2500m^3 of concrete was used in these elements, with 36% GGBS content in the reinforced components and 15% in the double-tees, meaning the building registers 355kgCO_2e/m^2, significantly bettering the LETI 2020 targets for best practice for sub- and superstructure of 390kgCO_2e/m^2. The use of GGBS at this percentage reduced the amount of Portland cement in the concrete, providing an environmental benefit, assisted with maintaining colour consistency and reducing risk of thermal crazing/cracking in larger sections due to lower hydration temperatures.

Use of the 229 double-tee units – which are generally 3.3m wide and weigh up to 18 tonnes each – also reduced the overall number of visible joints, while their welded edge shear connections minimise differential camber between the individual prestressed units.

Lift and stair cores

The lift and stair cores were constructed using PCE's PreFastCore modular system, providing a safe, fast, and dimensionally accurate solution, while giving stability to the structure.

Over 1300m^2 of prestressed concrete hollowcore units up to 500mm deep were also used in the structure, supported by composite cast in-situ reinforced concrete/structural steel Deltabeams providing flat soffits to the performance spaces, enabling ease of M&E installation and partitioning where required.

The visually exciting external colonnade structure comprises over 700m^3 of architecturally finished concrete units, nearly 400m^3 of which forms the 175 columns, beams and cladding panels cast using a Portland reconstructed stone mix with grit-blast finish to match that on the Surrey County Council offices across the road. The colonnade walkway floor units were cast with a black grit fines mix with a retarded finish to provide an integral anti-slip surface. Colonnade slabs and stairs also included the integrated trace-heating wiring to enable defrosting in winter.

The principle of concealed, embedded services was fundamental in terms of achieving the design aesthetic, with conduit runs, rainwater pipes, drainage channels and gullies, and lightning protection tape all concealed within the concrete structure.

To ensure the desired quality requirements were achieved (including accuracy of fit requirements, enabling the delivered product to be incorporated into the project on a first-lift basis without the need for any modifications or adjustments), PCE implemented enhanced factory production

Lobby. *(Photo: Ed Reeve.)*

Town House, Kingston University – front elevation. *(Photo: Ed Reeve.)*

Construction of frame.

quality control and checking procedures working with its off-site supply chain, which included Banagher Precast, Techrete, Shay Murtagh and Oranmore. These enhanced controls continued on-site with Willmott Dixon and PCE jointly implementing awareness training to all site operatives of the importance of the exposed concrete finishes and the implications of damaging the concrete.

The structural frame and colonnade – incorporating over 1900 individual precast units, using over 4500m^3 of concrete, and a further 1000m^3 of in-situ reinforced concrete – was constructed on time, over a 40-week period using two tower cranes and a highly trained multi-disciplinary site workforce of only 25 PCE personnel.

The project is rated as BREEAM 'Excellent' and offers a vibrant new front door to the university. It is outstanding in every sense, proudly promoting the use of exposed structural and architectural concrete to all.

The success of this project is underscored by the positive reaction of Kingston University and by the fact that student visits to the library went up six-fold compared with the same period in the previous year. ■

The Judges' Comments

The building has a series of open voids to promote space, light and collaboration of student ideas from various subject matter, ie, the noise of dance mixed with a quietness of the library.

The polished exposed aggregate concrete floor at ground level is well executed and the colour off-sets well with light grey concrete columns, beams and staircase. It also ties in well with the outside in-situ exposed aggregate ramps and bench wall at the adjacent existing building.

The open-texture finish of the concrete columns and beams – using a Portland reconstructed stone mix with a grit-blast finish – adds to the nature, like fossils in a cliff face, is excellent and marries up with the Surrey County Council offices. Attention to detail has been considered, eg, distance of joints between each unit is consistent, rebates under the external beams to reduce pathways from rainfall and the matching of the internal polished exposed aggregate in-situ concrete floor with adjacent external in-situ exposed aggregate concrete pavement.

Town House at Kingston University, Kingston upon Thames

Client	Kingston University
Architect	Grafton Architects
Structural engineer	AKT II
MEP engineer	ChapmanBDSP
Main contractor	Willmott Dixon
Concrete frame contractor	PCE
Precast suppliers	Banagher Precast/Techrete/ Shay Murtagh/Oranmore