

# Roebuck Hall Student Residence

## Self Compacting Concrete

The growth & expansion of Ireland's universities is one of the lesser celebrated successes of Ireland's modern economy. Driven by the demands of the 'knowledge economy' and by increasing affluence, far greater numbers of students are attending third level institutions than heretofore and this has given rise to an increased demand for on campus student accommodation.

In response to this demand, University College Dublin recently commissioned new student residence accommodation, located alongside Roebuck Castle in the South East corner of the campus. The new facility, which will be known as 'Roebuck Hall Residence', will accommodate 300 students in single bedroom accommodation. The development, designed by architects Kavanagh Tuite, features a novel form of concrete formwork construction which was both economical and efficient in terms of speed of construction.

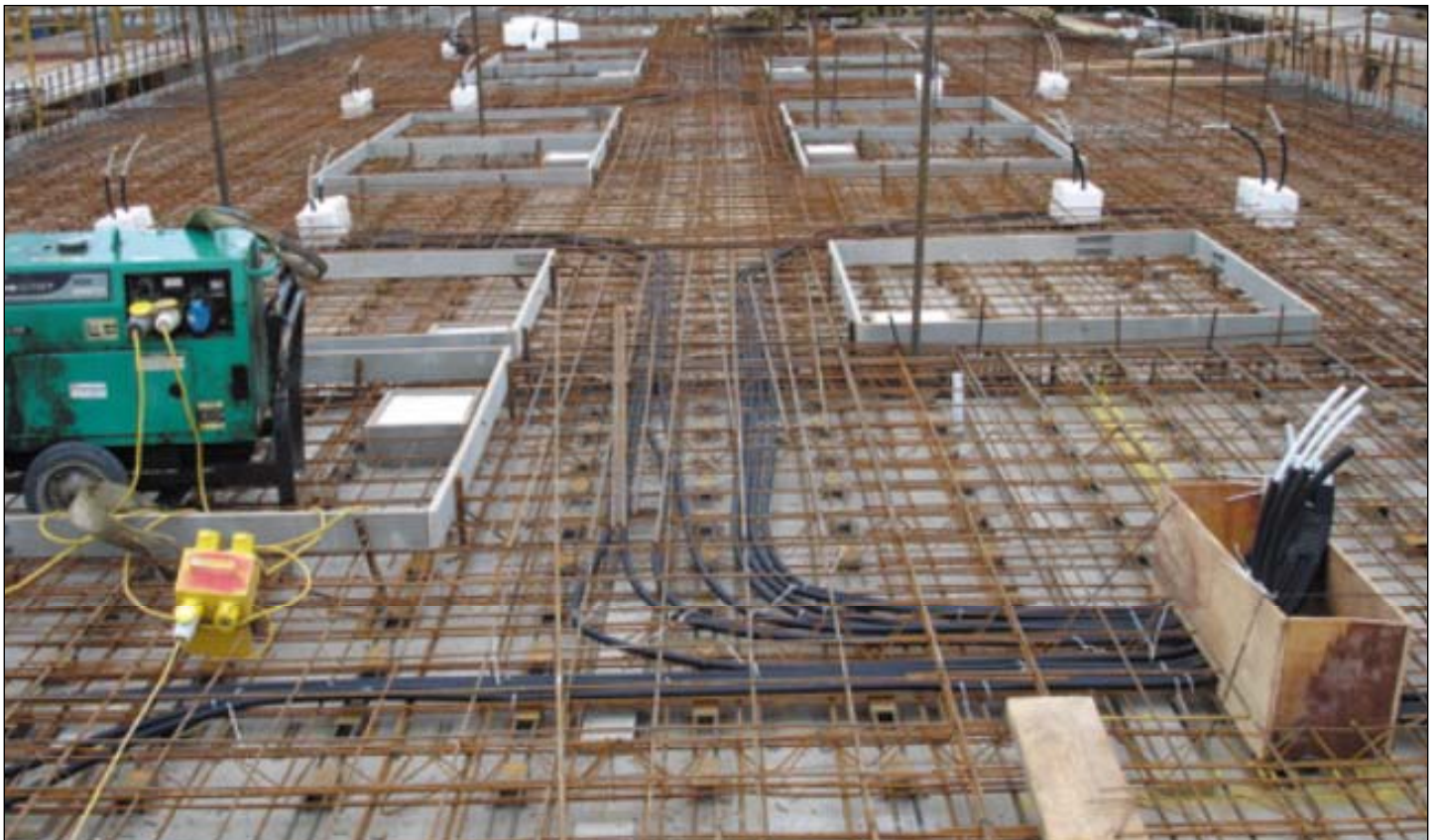
In designing the blocks, Kavanagh Tuite immediately opted for a modular approach based on student 'apartments' comprising of six student study bedrooms with shared living and dining rooms. The floor area of each apartment is approximately 130m<sup>2</sup>. The residence is constructed in nine blocks, in



clusters of three houses around a central core. The blocks are five and six storeys in height.

One of the principal design considerations, was to develop a high level of fire and acoustic separation/compartamentation both within and between the apartments. This objective was facilitated by the inherent fire

and sound properties of the concrete structure and by simple connection details between the concrete formwork walls and the insitu concrete floors. Internal stud partitions were finished with sound absorbing type plasterboard to achieve comparable ratings in the overall structure.





*Cement Particle Bonded Board Formwork*

### **General Structural Description**

The building is constructed with reinforced concrete primary walls and floors, including stair flights. Individual prefabricated pod type bathrooms were installed in each of the study bedrooms. To facilitate crantage, pods were installed at each floor level prior to the construction of the floor above.

### **Procurement Method & Preliminary Site Works**

To ensure the timely delivery of the project, an 'enabling works contract' was put in place for the significant excavation works. This contract included services diversions, site clearance, reduced levels and stone mattress to the building footprint. During the period of the enabling works contract, four main contractors were interviewed by the design team. Each contractor presented their favoured construction method. The main contract was placed by selective tendering following a public selection process under EC rules for the main contractor tender list. Tender documents were issued based on a

'standard' construction form, i.e. blockwork load-bearing walls and precast floor slab. The contractors were asked to price this standard form and to provide an alternative price for their preferred construction methodology.

### **Concrete Formwork**

The winning contractor was chosen because his structural scheme delivered on price, programme and flexibility. There scheme was based on a permanent formwork solution by Permanent Formwork Systems Ltd. (PFS) system. This comprises permanent shuttering of cement particle bonded board (Cetris), used in conjunction with Self Compacting Concrete (SCC). The formwork solution offered certainty in terms of the programme which required that the residence be operational for the academic year 2006/2007. The system also proved more economic than traditional forms of construction.

The high density particle board formwork had a high quality surface finish, eliminating the need for internal plastering

on partitions. The joints in the permanent formwork system were recessed during fabrication, allowing for seamless jointing. After initial teething problems, the taped jointing system was effective on site. A plasterboard ceiling was fitted throughout the building to contain wired services. All piped services, including heating and water service, were cast into the concrete floors during construction.

Wall panels were prefabricated off site and structural reinforcement installed in the panels. All openings were preformed and additional reinforcement over large openings was factory fixed. The Cetris floor shuttering had prefixed reinforcement location strips and was propped in accordance with specialist requirements.

The stairs formwork is also factory prefabricated. This system, in common with all prefabricated systems, requires finalised dimensioned drawings at an early stage. This proved to be a particular challenge on the Roebuck project because the design run-in time was very limited. This issue was substantially overcome

because small items such as the location of light switches did not have to be decided since minor holes could be cut into the shutter on site. This flexibility was an advantage over a number of other prefabricated systems

### Self Compacting Concrete

Self compacting concrete is specified for the entire structure. During all pours, remote parts of the formwork were removed after concrete placement to confirm the complete dispersal of the concrete within the forms. No cavities occurred at any stage during the superstructure construction.

### Structural Design Issues

Fixings to wall panels were considered in detail. The specialist proposal that wall ties and relieving angles could be fixed to the permanent shuttering was not accepted. Wall ties were fixed through the permanent shuttering to the concrete core. For fixings to relieving angles, strips of formwork were cut out and the angles were fixed directly to the concrete core. Issues such as vertical tying and perimeter tying were resolved without difficulty. The reinforced concrete provided a cellular and highly stable structure. Pod loadings were accommodated by excess capacity in the structural system.



### Structural Site Issues

A series of inspection slots were removed from the permanent shuttering as directed by Hanly Pepper. These were chosen in numbers and at random locations to check the effectiveness of the self compacting concrete. All points inspected were satisfactory. A minor difficulty arose in relation to alignment of the external walls, resulting in some variation in cavity widths. The wall face alignment and cavity width were maintained by using ties of varying lengths. Overall, the structural scheme was very successful and proved most suitable for the repetitive floor plans on this project.

### Project Principals

**Architect:** Kavanagh Tuite

**Structural Engineer:** Hanly Pepper

**Services Consultants:** Delap & Waller

**Cost Consultants:** Kane Crowe

Kavanagh

**Project Manager:** KSN Project

Management