

PROBABLY THE HIGHEST LIGHT STEEL FRAME STRUCTURE IN EUROPE

A 7, 10 and 12 storey light steel frame solution significantly reduced the construction programme and enhanced the buildability of this high quality student accommodation in Newcastle City Centre.

A Perfect Solution

Site logistics and construction efficiency are an important requirement for main contractors and the Kingspan light steel framing system proved to be the perfect solution for an extremely difficult site located in the heart of Newcastle's busy City Centre. At the pre-contract stage, the initial approach was to use a precast concrete frame system but the main contractor, Robertson, put forward a light steel frame solution designed by Kingspan. This decision proved to be crucial as the solution also reduced the overall pile foundation loadings by up to 40% in parts of the structure making the scheme viable in terms of development and funding for the client.

The New Bridge Street West project on the site of a former night club comprises of 3 separate tiered blocks (Block A: 12 floors, Block B: 10 floors and Block C: 7 floors) all linked together to form high quality accommodation for students attending the Universities of Newcastle. The total development provides 329 bedrooms that comprise cluster bedrooms and studios. It is believed to be the tallest panelised light steel load-bearing structure constructed in Europe with a total floor area of 8000 m².

From receiving the order in April 2016, Kingspan was on site 4 months later and completed the three multi-storey blocks in a record time of 7 months. The challenging site logistics meant that the tiered building had to be constructed and serviced using two tower cranes. It was critical to ensure crane hook availability was maximised at all times in order to achieve the intermediate floor concrete pour milestones which were detailed in the tight installation programme.

Light Steel Frame with Composite Floors

Composite floors are supported by load-bearing single leaf light steel walls at 2.9 to 3.7 m spacing. Generally, temporary propping was not required by using *Multidek* 80 decking in two thicknesses depending on the span. The overall construction cycle was approximately 7 days per floor that included placement of prefabricated bathroom 'pods' as each floor was completed.

The build-up of the external walls incorporated Kingspan's recently developed unique Benchmark insulated liner panel. The liner panel with a core thickness of 125 mm has a predicted weighted sound reduction $R_w = 24$ dB along with a U value of 0.16 W/m²K. The application of the Benchmark Wall Liner System provides direct support for the impressive rainscreen cladding enhancing the aesthetic appearance to the external façade.

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Aerial view of the ongoing installation in the heart of the city centre



Completed 10 and 12 storey blocks



Architects impression of the 7, 10 and 12-storey accommodation complex

Construction Details

Speed of Construction

The Managing estimator for the main contractor, Robertson, stated that: *“The original tender was to be an in-situ concrete podium level and a precast concrete panel wall and floor system to form the blocks above. The start date was proposed as January 2016 with completion for September 2017. We quickly looked at the scheme and it came clear that we could not meet these time scales and the tight site location meant the size of cranes required for 10-15T panels was not practical and also deliveries of precast concrete panels was difficult in such a tight site area. So we changed the design to a KingBuild LSF above the podium. For the taller blocks, concrete cores were constructed to certain floor heights for lateral stability”.*

The stated advantages to the main contractor of using the chosen light steel framing scheme were:

- Reduced load transfer to piles and smaller pile caps due to the lower self-weight.
- Programme advantage on installing light steel framing and by temporary weatherproof at certain levels that allowed earlier fit out.
- The perimeter walls used the Benchmark liner panel system that was pre-installed so 70% of external wall areas were weather protected.
- The tower crane costs reduced significantly by the 1T end load rather than 15T.
- Overall the scheme came in on budget (and the precast concrete option would have added about £1.5m to the overall cost.
- The construction programme would have been up to 10 weeks longer which would not have met the completion date.

Logistics

The construction of the 3 linked blocks of 7, 10 and 12 storeys height required extensive planning from a logistical viewpoint. There was no laydown area other than within the building footprint so effective transport scheduling was key to making the project a success. With only one area available for unloading from the road between the building and an adjacent hotel, an effective pedestrian segregation and traffic management system was employed to secure safe unloading and lifting operations.

All deliveries were scheduled at specified timed slots, which were coordinated with all members of the project team to maximise crane availability time and minimise disruption of local surrounding public activities. A total of 80 deliveries of light steel wall panels and decking meant that the whole construction programme was both efficient and had minimal impact on the locality. In a weekly cycle, there were three deliveries of light steel wall panels, one delivery of profiled steel decking. The concreting operation of approximately 300m² floor area for each block took place on one day per week.

As the installation of each floor progressed, modular bathroom pods and sealed plasterboard packs were loaded out into every room to minimise disruption in the latter stages of the fit-out works. Additional weather proofing was carried out to all blocks on levels 4, 7 and 10 which allowed follow on internal trades to commence with first and second fix and complete well ahead of schedule.

Application Benefits

- Tallest light steel frame structure in the UK.
- Rapid construction system, 7 days for each floor.
- Excellent acoustic and thermal insulation.
- Light weight (saving 40% on foundation loadings in some locations).
- £1.5 million saving using light steel framing in this £20 million project.
- Met the 15 month construction programme that was not possible in a concrete solution.

Project Team

Client:	Magnetic Ltd
Contractor:	Robertson Construction
Architect:	Ryder
Structural Engineer:	Cundall
Light Steel Framing:	Kingspan Steel Building Solutions

Construction Details

Speed of Construction

The height of the building presented the structural engineers with new challenges. The *KingBuild*® system consists of 100 mm and 70 mm deep 'C' section studs in gauges ranging from 4 mm on the lower floors to 1.2 mm on the upper floors. Diagonal bracing was installed to all the load bearing walls on the lower floors to resist the shear forces acting due to wind, and this allowed the structure to be designed to 12 storeys height. The key was to utilise the integral concrete stair cores of block A and B on the lower floors to supplement the structural stability of the light steel framing system.

The 7 storey Block C was started from podium level at the end of August 2016 and was completed in mid-November. The 10 storey Block B started in mid-October 2016 and was completed in mid-February 2017. The 12 storey Block A started in mid-November 2016 having handed over the first Block C and was completed in mid-March 2017. This gave the main contractor 5 months to complete the dry-lining, servicing and fit-out ready for hand-over to the client in August 2017.



Installation of light steel framing with pre-clad external walls

Intermediate floors used a composite floor with A142 mesh and 12mm diameter bar reinforcement and with C35 concrete grade. This floor build-up provided the required 90 minute fire resistance and also provided a high level of acoustic insulation between floors. Except for one 4.1m span area, the 2.9m to 3.7m span decking did not require temporary propping during concreting which speeded up the process. A total of 29 concrete pours was completed, most of which had to be skip hoisted due to limited access to locate a pump, which it turned tied up the crane during pouring operations.

As part of Kingspan's commitment to maintain route to Net-Zero Energy Buildings, the design team concentrated on the whole of the building rather than just focusing on a specific area. This resulted in provision of a superstructure with an enhanced external envelope allowing savings to internal building services.

The building was handed over 2 weeks early to the main contractor. Importantly for the main contractor, there were compelling logistical advantages in using light steel framing and has the first option of precast concrete been continued, the construction programme would have been up to 10 weeks longer which would not have met the client's completion date. The light steel framing solution also saved on the cost of the podium structure and foundations and led to a £1.5 million overall saving in this £20 million project.

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