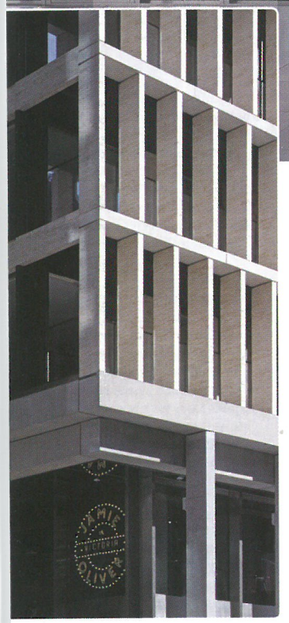
2015 SHORTLIST

Zig Zag Building and Kings Gate, London



Zig Zag Building façade – view from Victoria Street.

Above: Column detail in reception.

Left: Interior column detail.

The Zig Zag Building and Kings Gate are the two buildings that replaced the former Kingsgate House on Victoria Street. The Zig Zag Building is for commercial use, while Kings Gate is a high-end residential building and part of a wider development that features a new public realm and thoroughfares, gardens, retail and restaurants.

From Land Securities' (client) perspective, the Kingsgate Development adds significant value to the site, transforming it from a 1960s plain office block building to a modern mixed development. It will consist of retail, office and residential accommodation, enhancing the visual appearance and in harmony with the surrounding sites.

Lynch Architects designed the two buildings in the development and looked for a high-quality fair-faced finish for the exposed concrete elements that required careful consideration in the choice of cement, coarse and fine aggregate. Structural engineer Pell Frischmann designed both buildings in reinforced and prestressed concrete, with performance requiring high strength and durability, while meeting sustainability aspects. The proximity of Transport for London rail traffic required the site environment to include acoustic and vibration isolation to meet occupant comfort levels.

Significant logistical challenges in the methodology of constructing the substructure and superstructures within the tight programme were identified. These included: tight site constraints with heavy city centre traffic; proximity to the London Underground train tunnels; advance delivery of a UK Power Networks (UKPN) substation in the middle of the site; excavation and construction for the three different sections of the site; spoil removal and delivery of construction material to the confined site; extended fit-out period for the residential building; and the installation of the acoustic and anti-vibration bearings.

The early delivery of the UKPN box was required not only to supply the site but also the surrounding area.

Approach to design

The construction of the UKPN basement involved open excavation within temporary sheet piles, contiguous piles and perimeter secant pile walls with temporary props. The thick concrete raft required mixes with low heat of hydration, by using up to 35% GGBS cement replacement. The target strength was extended to 56 days rather than 28 days and this was considered acceptable as the full strength would not be required until the full superstructure was in place.

The Kings Gate residential building had a long fit-out period, restricted access for spoil removal and the construction of the five-storey basement. A top-down method of construction was adopted for this area of the site. The basement slabs were constructed on prepared formation over plunged columns. To achieve a high-quality soffit finish to the top-down slab, a plywood surface was laid over blinding on the prepared formation for the slab.

Vehicle ramps were located on the north side of the basement on all levels. This added complexity to the setting out of levels for the formation surfaces. The concrete for the top-down basement slab was designed to have an early strength gain to allow excavation below the slab to commence as soon as possible, usually between seven and 14 days after the slab was poured. At that stage, the suspended slab needed adequate strength to support its own weight, plus construction load on top.

The basement slabs' diaphragm action provided lateral support to the perimeter secant pile retaining walls. The B1 slab provided a working platform for the construction of the substantial concrete transfer beams that supported the acoustic bearings below the ground-floor slab. Temporary openings were left through the ground-floor and basement slabs to permit the long-reach excavator to remove spoil from the excavation works. The openings also enabled access for delivery of reinforcement and concrete for the construction of the basement slabs.

Adopting concrete construction

The construction of the superstructure core followed immediately when the top-down ground floor was completed. Top-down construction allowed the construction of superstructure and substructure at the same time, thus gaining programme advantage to allow the fit-out for the superstructure to start much earlier than a traditional bottom-up construction method.

The basement for the west Zig Zag Building was constructed in a traditional bottom-up manner following the completion of the UKPN basement. The delayed start of this area provided construction access and material laydown for the excavation and construction of the UKPN box in the centre. A temporary steel gantry platform was introduced on the north side of the site to support long-reach excavators and to provide access for spoil removal, concrete and other material delivery, thus overcoming the constraint from the surrounding roads.

Concrete delivery was distributed to pour locations via static pumps and pump masts. In this area of the site, the lowest basement was constructed following full excavation to the lowest formation level. The temporary props were removed progressively as the basement slabs below were completed; this provided the lateral supports for the perimeter walls. The main cores for both buildings were constructed using slipform. The Zig Zag Building core was constructed from the lowest basement and the Kings Gate building started from the acoustic-bearing-supported ground floor. Concrete for the slipform cores was designed to meet performance criteria, which required a setting time appropriate for this type of construction.

A mix design was prepared to be called up from site to suit varying weather conditions and rate of pour. Due to working hour constraints, slipform was based on a 12-hour-day/five-day-week cycle. The horizontal concrete joint surfaces were prepared at the end of each shift. The slipform core wall surfaces were made good where required and the surface worked from trailing platforms as the form progressed, to provide an acceptable surface finish.

Significant features

The superstructure slabs for both buildings were constructed in post-tensioned concrete. An as-struck concrete soffit finish was specified for the office building, requiring fair-faced concrete soffit formwork with minimum visible reinforcement support, not only for the post-tensioning strands and reinforcement but also for the embedded cooling coil elements. The co-ordination between the reinforcement, post-tensioning strand and cooling coils was a challenge, and special methods of supporting these embedded elements were adopted. The embedded cooling coil created an energy-efficient slab, enhancing the thermal performance of the building.

For the fair-faced concrete, extensive trial mixes were carried out with close collaboration between the concrete supplier Hanson, the main contractor Lend Lease and the design team to achieve the acceptable colour, texture and appearance of these exposed elements.

Numerous trial concretes include the use of mica sand, colour pigment and different types of cement. To achieve the high BREEAM rating and lower embodied carbon, different amounts of cement replacement material such as GGBS and fly ash were considered. Recycled aggregate was adopted in some concretes in order to meet not only appearance but also strength and sustainability requirements.

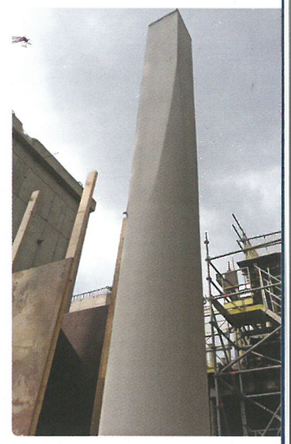
Mica sand as a waste product from china clay mines has been used in the high-quality-finished feature columns. This provided a glittering effect on the columns as required by the architect.

For the fair-faced concrete circular columns, the original design specified precast high-strength spun concrete column shells, which were manufactured in Germany. This was not considered to be cost-effective or environmentally sustainable when considering use of material and transportation. The elements were also liable to damage during transit and installation. Hence, an in-situ option was considered and adopted. Extensive trial mixes and column samples were produced with different types of formwork, pour rate, consistence and curing methods to achieve the colour, texture and strength requirements acceptable by the design team.

The Rapidobat single-use circular column form was chosen as a recyclable and economical formwork. Its internal lining with PVC gave a high-quality fair-faced concrete finish. The double-height feature columns on the ground floor, which change from circular to square shape, required special adaptation of the column forms to achieve the profile required.

Careful consideration was given to the use of suitable concretes to suit different performance requirements for the various sections of the project. While the aspiration was to use as much cement replacement as possible to reduce embodied carbon, it was often restricted by other performance requirements in appearance and strength.

Recycled aggregate and material has been used for this project but was restricted by consistency and availability from source. Mica sand, fly ash and GGBS cement replacement material were delivered to the concrete mixing plant in King's Cross by rail. Hence the road transportation of concrete material was kept to a minimum to reduce the carbon footprint for the project. ●



Double-height feature column for the Zig Zag Building.

View from Victoria Street.

Zig Zag Building and Kings Gate, London	
Owner	LS Kings Gate Residential
Architect	Lynch Architects
Structural engineer	Pell Frischmann
Main contractor	Lend Lease
Concrete contractor	PJ Carey (Contractors)
Concrete supplier	Hanson Concrete

Judges' Comments

For the Zig Zag Building, the spacing of the fins has been changed as the building rises (closer at the top), so that it doesn't look too tall for the surroundings. For Kings Gate, the fins are closer together at the bottom to give more privacy. Workmanship and finish is where this project stands out. In the judges' opinion, the circular columns are the most even-coloured, blemish-free columns ever seen – so much so that they don't look like concrete. The two-storey white concrete feature column (C90, SCC pokered concrete) is exceptional; again it is so even coloured that it looks as if it has been painted.

The rectangular columns have been surface ground to expose the aggregate and are very high quality, as were the exposed soffits.

The soffits of the top-down basement slabs are very good quality considering the method of construction. The brush finish to the top of the sloping slabs is also very good quality considering that the S3 concrete had to be pumped into place.