CONCRETE QUARTERLY | SUMMER 2011 | ISSUE NUMBER 236

ALPINE PEAK
The Swiss conservation centre that's scaling the world's toughest eco standards

SOMETHING FRESH
Bennetts Associates' Mint Hotel – a cool city slicker in one of London's most venerable districts

SOLID AIR
Concrete soars to new heights at the Polish Aviation Museum in Krakow

mpa
The Concrete Centre

WELCOME

BOLD AND BEAUTIFUL

More than any other material, concrete has the ability to deliver architecture that provokes a response and an interaction. This is certainly the case with the International Union for the Conservation of Nature (IUCN) headquarters, the Vodafone offices in Oporto and the Polish Aviation Museum (all in this issue). Each uses concrete to make a dramatic design statement. Bold, confident and with purpose, these buildings converse with their users and their location. But concrete can provide a restrained presence, too, as demonstrated by the new Mint Tower of London hotel (page 10).

Whatever the design statement, concrete earns its performance credentials. The IUCN centre shows how concrete's high levels of thermal efficiency can provide unrivalled sustainable solutions; the client for the Mint hotel insisted on concrete walls for its sound insulation and fire resistance; while the exposed surfaces of the Polish Aviation Museum fulfil the aesthetic aims of the project team.

What all of these projects demonstrate is that concrete design and construction can perform loudly or quietly, with bravado or with restraint while being cost-effective and sustainable.

Guy Thompson
Head of architecture and sustainability
The Concrete Centre
www.concretecentre.com/cq

NEWS ROUND-UP

New guidance to assist on the road to zero carbon

Guidance from The Concrete Centre will shed light on achieving thermal performance targets for new homes, revealing the findings of a study into how best to meet current and anticipated requirements for Part L1A of the Building Regulations.

The importance of thermal performance in heating and cooling buildings is underlined by the recent Fabric Energy Efficiency Standard (FEES) for new homes, which takes account of a dwelling's year-round space heating and cooling needs.

Fabric performance is key to achieving the target of zero-carbon homes by 2016, through enhanced levels of airtightness, insulation and reduced cold bridging. The inherent thermal mass of medium and heavyweight construction will play an increasingly important role.

The document also provides guidance on general Part L/SAP design issues, with an emphasis on the use of concrete and masonry. Whilst focusing on Part L compliance, the information provided is also relevant to the Energy category of the Code for Sustainable Homes.

"Thermal Performance: Part L1A" is available now to download from www.concretecentre.com/publications

IN THIS ISSUE

On the cover: AGPS's International Union for the Conservation of Nature headquarters in Gland, Switzerland

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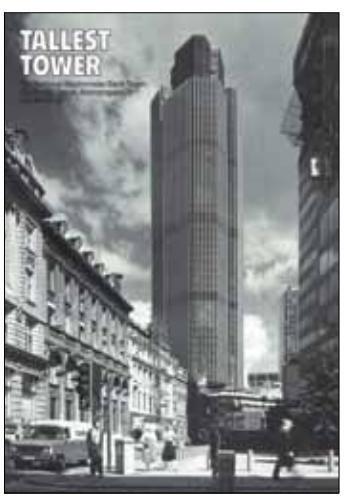
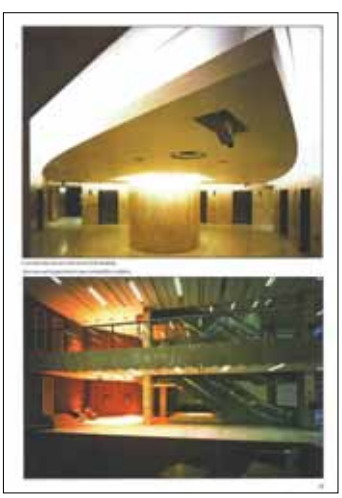
www.mineralproducts.org

ARCHIVE





RETRO CONCRETE: SUMMER 1981

A royal wedding and a transformation of the London skyline... The 600ft National Westminster Tower becomes Britain's tallest building and CQ anticipates it will become "the ultimate apotheosis" of the office tower, overcoming prejudices against towerblock living to redeem "this unfashionable building type". Meanwhile, architect Richard Seifert says: "Today buildings have become much more complex ... [creating] a fragmented building operation which does not rely solely upon the architect's decisions ... the architect now has to rely upon the coalescence of other participating professions."

This translucent and light-transmitting concrete cladding is part of an installation that attempts to recreate the experience of hallucinogenic drugs, entitled CCPP or "Space, light, sound and drugs". It was produced by concrete moulding specialist Butong, working with design collectives Cochenko and Quatorze, and will tour French schools and institutions as part of a drug awareness campaign, commissioned by the French Ministry of Culture. **For more information, go to www.butong.eu**

Chipperfield wins EU prize

David Chipperfield's remodelling of the Neues Museum in Berlin has won the 2011 European Union Prize for Contemporary Architecture, the Mies van der Rohe Award. The project, which uses concrete to great effect to fuse the elements of the reconstruction into a comprehensive whole, was featured in CQ Spring 2009.

To watch a video about the project, go to: www.concretecentre.com/webcasts

This is Concrete

Want to find out about exemplar concrete design and construction projects? The "This is Concrete" campaign aims to encourage debate and project-based feedback on a wide range of concrete issues and projects. It offers factual evidence, case studies and videos, real-time Twitter updates and a newsletter.

For more information, and to take advantage of all these online resources, go to: www.thisisconcrete.co.uk

Specifying sustainable concrete

A new publication from The Concrete Centre aims to assist designers in optimising the sustainable credentials of concrete.

Concrete's flexibility and inherent properties offer many opportunities for designers to optimise a development's wider impact, including performance credentials such as fire, durability, acoustics and adaptability.

The guide, entitled "Specifying Sustainable Concrete", focuses on concrete's constituent materials and how specification variation can influence the sustainability of concrete.

To download a free copy of the guide, visit www.concretecentre.com/publications

CONCRETE ELEGANCE REVIEW

A collegiate court provides space to think at the Sainsbury Research Laboratory in Cambridge

BACK TO NATURE AT THE BUILDING CENTRE

Concrete at one with nature was something of a theme at the most recent Concrete Elegance event held at the Building Centre in London. The lecture featured Stanton Williams' Sainsbury Research Laboratory in Cambridge, a landmark building with a collection of over 1 million plant specimens, including those collected by Darwin during his voyage on the Beagle. The building is conceived as a sequence of spaces that interact with the surrounding botanic garden, connected by a continuous route that recalls Darwin's own "thinking path". The structure uses layers of exposed in-situ concrete and limestone to produce a strata-like effect, and provide a solidity that balances the permeability of expanses of facade glazing.

Also on show was the new Dover Esplanade, designed by Tonkin Liu Architects, which seeks to echo the architectural language of Dover itself, with sculptural walls, ramps and staircases of white concrete that recall waves falling upon the seashore and the topography of the White Cliffs.

For information on the next Concrete Elegance lecture go to www.concretecentre.com/events

FURTHER VIEWING

Take a virtual tour of David Chipperfield's Hepworth Wakefield gallery, an intriguing geometric structure on the banks of the River Calder, featuring a facade made from pigmented concrete, poured in-situ to produce a monolithic impact. **To view the video, go to www.concretecentre.com/webcasts**

FORCE OF NATURE

The new headquarters of the International Union for the Conservation of Nature in Switzerland uses the power of the sun and the thermal mass of several different kinds of concrete to cut energy use to new lows. **Tony Whitehead** explores one of Europe's most sustainable buildings

Concrete balconies run around both levels, with balustrades that echo the zigzag profile of the photovoltaic panels

Minimalist in design, heated by rocks and powered by the sun, the headquarters of the International Union for the Conservation of Nature (IUCN) in Gland, Switzerland, is an exemplar sustainable building achieved on a tight budget.

Comprising 5,400m² of accommodation spread over two floors and a penthouse suite, the new conservation centre has an earthy, Spartan look that some will find just too basic for comfort. Others, however, will love its spacious geometry and boldly functional style.

But the real attraction of the building is that it is one of the most sustainable of its kind ever built. It uses only 20% of the energy a standard building of the same size would consume, and as such is a fascinating object lesson in environmentally friendly building.

The IUCN itself admits it is "a provocative building" and hopes it will inspire similar projects in the future. It adds that the building is also "a veritable showcase of modern and emerging concrete technology, featuring a low CO_2 concrete, 'recycled concrete', prestressed, insulating, precast and ready-mixed concrete".

The building uses both a 180m-deep geothermal heating and cooling system and a prototype CO_2-controlled ventilation system, and the team had to complete it within a tight budget of 25 million Swiss francs (£17.4m) – no small achievement.

"Certainly, this was not the easiest building I have ever been involved with," admits Jean-Manuel Megow, project manager with total services contractor Karl Steiner SA. "But I enjoyed it. We learnt a lot, and created something out of the norm, which is always more interesting."

The defining feature of the project was the desire of the IUCN to build to the highest environmental standards it could find. These were Switzerland's own Minergie rating and the US-developed LEED system. IUCN told designers they would have to meet both standards – despite the fact that, as far as anyone knew, no building had ever before been built which achieved all of these criteria. As a further challenge, the budget was no more than for a standard office building of similar size. In fact, the Minergie standard insists that costs remain comparable with "normal" buildings.

Things did not at first go smoothly, which makes the eventual completion on time and cost even more impressive. The first architect left after a year and a second competition was held. The remit was, if anything, tougher still, as programme and budget had now been diminished by the false start.

Zurich-based practice AGPS took over in 2007 and, in the interests of getting on with the job as

KEY FACTS

COST £17.4M
BUILDING FOOTPRINT 3,400 M²
GROSS FLOOR AREA 5,400 M²
U-VALUE OF WALLS 0.1 WATT/M²K
U-VALUE OF TRIPLE GLAZING 0.5 WATT/M²K
U-VALUE OF WINDOW ASSEMBLY 0.7 WATT/M²K

'We had to enter unknown territory'

The job of ensuring that the several different types of concrete used in the conservation centre all performed structurally fell to Claudio Pirazzi, of Geneva-based engineer INGENI SA.

"We had to enter unknown territory," he admits. "We had not worked with recycled or insulating concrete before, and the material properties were not all fully known at the outset, so we had to conduct research and form hypotheses."

Pirazzi says that since recycled concrete is not as frost-resistant as that made with ordinary aggregate, the ground slab was cast in standard, in-situ concrete. "The other three slabs are not in direct contact with the weather, so these are all cast using aggregate substitute recycled from local demolitions," he says, adding that these slabs – amounting to some 40% of the total concrete used in the building – were also were CO_2-reduced by using limestone fines as a secondary cementitious material.

All precast elements – including the columns and balcony balustrades – were cast locally using standard concrete.

Most challenging for Pirazzi was the entrance tower. Connecting the old building with the new, and housing a staircase within it, this has its own highly unusual structure, built as it is from a massive monolith of insulating concrete.

"This element passes through the heated area of the rooftop suite, all the way down, via entirely exposed exterior areas, into the closed but unheated basement," explains Pirazzi. "Using insulating concrete means that one material can be used for all these areas."

Pirazzi says that this concrete is a seven-times better insulator than ordinary concrete, but it is not as effective as rockwool. "So we played upon thickness," he says. "We made the insulating concrete 55cm thick."

He explains that using a single material through different parts of the building gives a simplicity to the design that was also cost-efficient.

"But there were structural issues," he says. "This type of concrete is very light and about three times less resistant than standard concrete. It is not usually used in this way so, even at the thickness we were using it, we had to conduct many tests to ensure it would be strong enough to support the entrance tower and provide earthquake resistance. Fortunately, the tests confirmed our original hypotheses."

PROJECT TEAM
Contractor Karl Steiner SA
Architect AGPS
Structural engineer INGENI
Mechanical engineer Amstein + Walthert

fast as possible, presented interested contractors with five schematic plans at 1:200 scale. AGPS's Hanspeter Oester says: "It was quite unusual. There were no details, no quantity survey, no building permit. Because of these circumstances the project panel chose Karl Steiner SA as much on its record and attitude as its approach to the design."

AGPS realised at once that the building would have to be quite radical to meet budget, programme and environmental targets, and Oester says that it was conceived as a concrete structure right from the start. "It had to be similar to something we had done before – there was not time to start from the beginning," he says. "We had used concrete to create low-cost, highly sustainable buildings before – at Zurich airport for example – and we knew we could make it work for the IUCN. Concrete offered a high thermal mass, a strong frame, and low cost."

At 78m x 42m, the structure is rectangular on plan with one interior atrium and one 'cut-away' atrium on the perimeter. It has a basement car park, two storeys of accommodation, including office and exhibition space, a library, a cafe and a penthouse conference facility – all linked to the IUCN's similar-sized existing stone-clad building.

The new building is heated and cooled by 15 180m-deep heat exchanger loops. Heat transfer fluid is pumped through the building in pipes which take it to ceiling-mounted convectors that warm the air in winter and cool it in summer. They also directly heat or cool the concrete structure, the thermal mass of which eliminates peak loads. Ventilation is controlled by sensors which react to

LEFT
Photovoltaic panels provide most of the building's electricity

Photos: Alain Bucher

the CO_2 exhaled by occupants.

A striking feature of the building is the concrete balconies that run around both storeys. These have concrete balustrades precast in panels shaped to echo the zigzag profile of the rooftop photovoltaic panels. Oester says: "The balconies act as fire escapes and also give shading to prevent solar gain to the storeys below."

And there was another sustainable reason for choosing concrete: "We also had a focus on using local suppliers where possible and this part of Switzerland has a long tradition of supplying precast concrete."

ABOVE
Internal areas are used as semi-office space, as concrete balconies remove the need for fire-rated corridors inside

ABOVE RIGHT
The centre is linked to the IUCN's existing stone-clad building

He adds that some of the balustrade's concrete panels were sandblasted to achieve an almost natural stone look. "This helped create a unity with the travertine of the original building, which steel balustrades, for example, could not have done."

A further consequence of the balcony design is that there is no need for fire-rated corridors within the building. Internal circulation areas can be used as semi-office space, and virtually all the interior can be easily reconfigured for changing uses.

"Inside you also notice the concrete is not painted or coated or clad – nothing," says Oester. "But we have wooden doors, oiled wood hand rails and guard rails. The things you feel, we have tried to make smooth and nice to touch. It balances the natural texture of the concrete."

New technologies, new materials – and just 18 months to get the job done

Karl Steiner SA first became involved in the project in 2007, working with AGPS and the client to reduce costs. "There were many occasions when we had to say, 'We cannot do this for the money'," says project managerJean-Manuel Megow. "But because we were honest about this, and had an open relationship with the designer and client, we managed to agree a way forward."

Steiner then agreed to complete the project for a fixed price. Construction and tender documents were drawn up, LEED requirements inserted into contracts with subcontractors and the contractor moved on site in June 2008 with an 18-month schedule.

The concrete frame was completed on time by January 2009. Megow says it was a fairly straightforward process: "We had very good support, both from Holcim, which provided much of the concrete, and also the structural engineer INGENI."

Special measures did have to be taken though, to comply with the finer details: "LEED forbids the use of expanded foam sealant in the formwork, so we had to use an ancient method of rope and sand instead."

Work on the triple-glazed facade was completed by April, but then the contractor met its biggest challenge. The ground floor slab is open to cold air in the basement garage below, and so the topside had to be covered with 36cm of insulation to protect the interior from cold bridging.

As Megow explains, the difficulty lay in incorporating the new technology within the insulating layer without compromising its performance. "The decentralised system of heating and ventilation was very new. Combining the technology with the insulating screed was very complex, and took us longer than the planned six to eight weeks."

Steiner spent the early part of the summer of 2009 wrestling with the problem, but with the screed finally laid and dried, interior fit-out could begin. This went smoothly and, despite the earlier delays, the building was completed in January 2010.

TALK OF THE TOWN

The Vodafone building in Oporto has been labelled "one of the most amazing creative offices in the world", and its extraordinary shape would not have been possible without the use of concrete

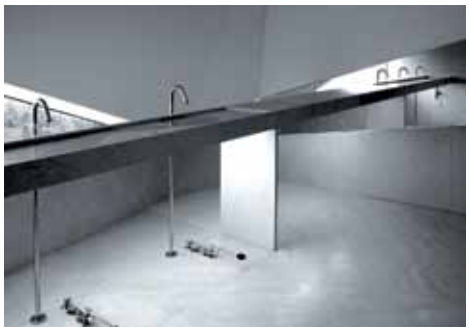
PROJECT TEAM
Client Vodafone
Architect Barbosa & Guimarães
Engineer Carlos Quinaz
Contractor Teixeira Duarte

LEFT
Irregular concrete shapes give the building its distinctive sense of movement
BELOW
Natural light is provided through continuous jagged lines of windows

Photos: Paulo Lima

The design of the new Vodafone offices in Oporto, Portugal, is inspired by the company's slogan "Vodafone life, life in motion". Architect Barbosa & Guimarães has taken the slogan and created a building of movement and dynamism. The irregular geometry of the structure challenges a number of preconceptions – most notably, preconceptions of concrete as a construction material. The realisation of this building has been made possible not only by the structural strength of concrete but also by its flexible plasticity. This has allowed the irregular and faceted freeform shapes that give the building its distinctive sense of movement.

Concrete is responsible for more than just the exterior panache; it also supplies a full structural solution. The building has a peripheral structural shell of concrete, with internal support reduced to two stairwells and three central pillars. This provided the architect with the freedom to create such technically complex forms and versatile internal spaces.



The internal spaces are clean and uncluttered

The 7,336m^2 building has eight floors, five above ground with three basement floors. On the ground floor is a Vodafone store and cafe. The four floors above house the offices. In the basement are training suites and car parking. Natural lighting is provided through continuous jagged ribbons of windows cut into the length of the north and south elevations. The main volume of the office building faces Boavista Avenue where, in acknowledgement of the buildings to the east and west, the office rises from three to five storeys.

The overall impression of this building is of creativity, fun and architectural quality. Style website The Cool Hunter has described it as "one of the most amazing creative offices in the world". Letting loose concrete's innate plasticity has created a building that is indeed "life in motion".

In-situ reinforced concrete is draped over the glazing

Photos: Jakub Pierzchała & Marcin Przybyłko, Dariusz Rutkowski; Jens Willebrand

PAPER AEROPLANE

Concrete's playful character is revealed by the origami-like folds of the Polish Museum of Aviation in Krakow

ABOVE From above, the building resembles a propeller
LEFT Interactive kiosks provide information on the museum's collection

The Museum Lotnictwa – or Polish Aviation Museum – in Krakow houses one of the world's largest collections of historic aircraft and aviation-related artefacts. Designed by Pysall Ruge Architekten, the 4,500m² main building takes its inspiration from the site's history as the former Rakowice-Czyzny airport, built in 1912 for the Austro-Hungarian empire's air fleet 7. The old aircraft hangers set the scale of the new building with a vast footprint of 60m x 60m and a soaring height of 12m. The architects have sought to capture the spirit of both the collection and the location in an expressive and emblematic structure that combines aviation symbolism with technological prowess.

Divided into three triangular wings, from above the building resembles an aircraft's propeller. In two wings there are exhibition spaces, a cinema and a conference room. The third contains a library, cafe and administration offices. The central hub of the "propeller" provides the entrance hall. The wings are generously glazed, providing ample natural light and tempering the solidity of the structure.

The museum houses one of the world's largest collections of historic aircraft

The geometric concrete structure folds over the glazing like a paper aeroplane or a piece of origami. The walls are constructed from in-situ reinforced concrete and the roof from reinforced concrete panels supported by a steel semi-space structure. The concrete appears to drape over the glazed areas, lending a lighter and more playful character and also serves a practical purpose – it protects the exhibition space from direct exposure to the sun.

Internally the concrete is left exposed, its visual robustness reflecting the light that streams in through the floor-to-ceiling windows and seeming to ground the collection of exhibits from the realm of flight. Throughout the museum the finishes are natural and subdued so as not to detract from either the exhibits or the external views offered by the large walls of glazing.

One of the nominations for the prestigious 2011 Mies van der Rohe Award, the Polish Aviation Museum provides a symbolic and modern architectural structure that is closely allied with historical aviation. Importantly, this symbolism has not been at the expense of practicality. The three wings provide a logical and efficient layout and the structure complements rather than dominates the adjacent buildings – demonstrating that this building is no mere flight of fancy.

PROJECT TEAM
Client Muzeum Lotnictwa Polskiego w Krakowie
Architect Pysall Ruge Architekten
Engineer Arup

HOW REFRESHING

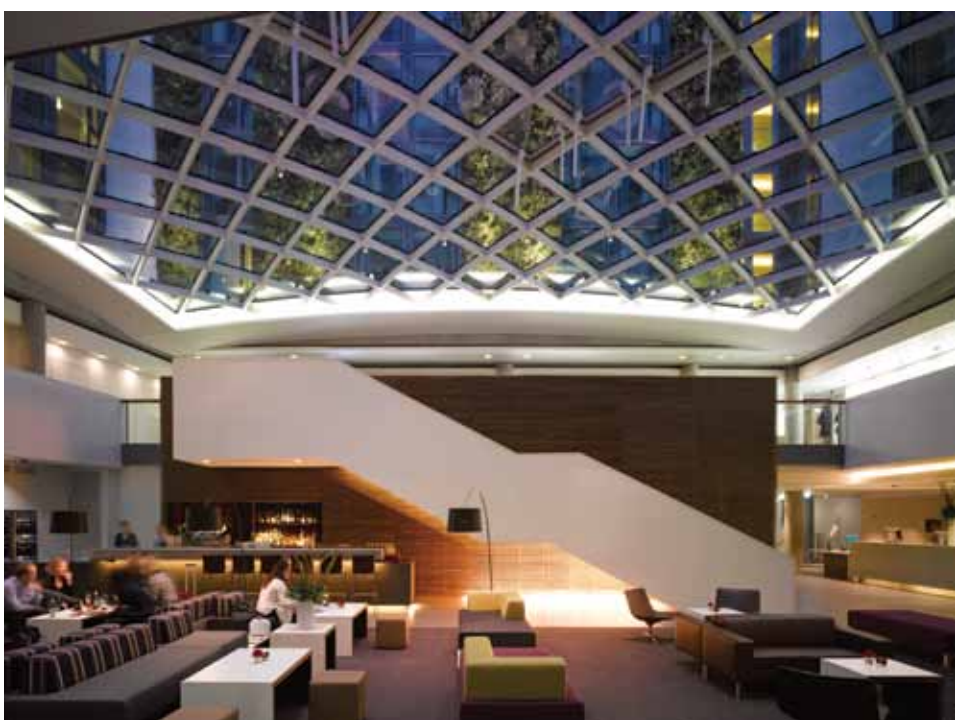
The Mint Tower of London, Bennetts Associates' new 12-storey, four-star hotel in the City, is concrete at its coolest

ABOVE
High-quality shuttering was used for the exposed concrete in the public areas

With 583 bedrooms, the new four-star Mint Tower of London is one of the largest hotels to be built in central London. The building takes the form of a broad courtyard with the facades following the medieval street lines of the adjoining area. There is a smooth sequence of spaces that takes hotel visitors through from a colonnaded entrance to a dramatic sky view.

Visitors approach the hotel through the substantial external colonnade before entering a double-height lobby that occupies the entire courtyard space. A vaulted glass roof marks the division between the public areas and the bedroom floors. Ascending past the bedrooms, visitors come to the SkyLounge, an imposing structure perched on top of the 12-storey building that cantilevers over the lower levels and offers spectacular 360° views over the City of London and the River Thames. In addition to the SkyLounge, the hotel has a restaurant, two bars and conference facilities.

Another feature of the hotel is the nine-storey living wall that covers the south-facing side of the courtyard. The living wall covers a massive 1,025m^2 and is thought to be tallest green wall in Europe. Starting from the second floor, it reaches the 11th floor of the internal courtyard, and also wraps around the outside of the hotel from the ninth



A double-height lobby occupies the entire courtyard, with a smooth sequence of spaces

storey up, before connecting to the green roof area. The wall will help to reduce the urban heat island effect and to combat water run-off.

Due to the physical limitations of the site and the time restrictions imposed by the City of London, the best structural solution was determined to be precast concrete twinwalls and lattice slabs with structural topping. Secant and load-bearing piles, to a depth of 20-25m below the basement slab form the foundations – 35% of the load-bearing piles on the western side of the site incorporated geothermal pipe work as a contribution towards the Greater London Authority planning requirement for 10% onsite renewable energy. In-situ concrete construction met the complex structural requirements of the basement to the second floor, including accommodation of wider structural grids and service routes within the depth of the transfer structures. The use of high-quality shuttering ensures an excellent finish for the exposed concrete in the public areas.

A key requirement for the client was for all walls between rooms to be concrete, which provides high levels of inherent thermal efficiency, fire resistance and sound insulation. The nine bedroom floors are therefore constructed in precast twinwall, precast columns and precast lattice slabs with a 130mm concrete topping. Four cores on the project were constructed using a jumpform falsework solution, and precast staircases were incorporated within these cores.

The structure was designed around a design, fabricated, manufacture and assembly (DFMA) process in order to improve production, programme and quality. Precast components were manufactured off site in factory conditions to ensure a high-quality finish. This meant that the rooms as well as the external facades only required a spray plaster finish and ensured that the tight programme limitations could be met. Adopting the DFMA process also reduced high-risk activities on site, such as working at height.

Replacing a non-descript 1960s building, the hotel has a strong urban character, providing a new hospitality and leisure venue and a focus to the surrounding area. This is the second London project that Bennetts has carried out for Mint Hotels. A third hotel is nearing completion in Amsterdam.

Photos: Ed Sumner

ABOVE
A living wall covers a massive 1,025m² from the second to the 11th floor

PROJECT TEAM
Client Mint Hotel
Architect Bennetts Associates
Engineer AECOM
Main contractor Laing O'Rourke
Concrete contractor Expanded Structures
Landscape contractor Frosts Landscape Construction