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Forest dweller
Perring Architecture & Design has proved that low-energy New Forest living is achievable through concrete innovation

Found in translation
The design of O'Donnell & Tuomey's cultural centre for the Irish language in Derry is inspired by Ireland's heritage

Going for gold
Fifty years on, Pier Luigi Nervi's three stadiums in Rome set the benchmark for safeguarding a successful Olympic legacy

Welcome

Concrete sensitivity

Believe it or not concrete has a sensitive side. Down in deepest Hampshire, in the New Forest National Park, concrete has demonstrated its ability to provide an eco-building that is environmentally and visually sensitive.

Meanwhile, its urban sensitivity is shown by the respectful classical reference of the Parabola Arts Centre in Cheltenham and the new Hilton Hotel in Liverpool to their 18th and 19th century neighbours.

You do not have to be soft to be sensitive. The hard surfaces of the Cultúrlann Uí Chanáin in Derry and the long-term performance of Nervi's Olympic structures in Rome have a strength that is robust yet still offers sensual tactility. Sensitivity can come in many forms, as can concrete design and construction.

CQ expansion

In order to enable more members of the project team to appreciate the benefits of concrete design and construction, CQ is expanding its horizons. It will now alternate publication between BD and Building. It will continue to champion projects that provide concrete aspiration and inspiration. CQ will now also alternate a focus on design with that of buildability. Both are areas where concrete excels. The summer issue of CQ will therefore be published with Building. We look forward to welcoming and inspiring both existing and new readers.

Guy Thompson
Head of architecture & housing, The Concrete Centre
www.concretecentre.com/cq

Inside

On the cover: Perring Architecture & Design's New Forest house

News round-up

Going underground could solve UK housing

A new report from The Concrete Centre shows there is a solution for building larger and more energy efficient homes right below our feet — in the basement.

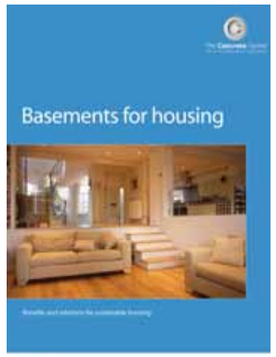
"Basements for housing" highlights the benefits of building underground, which include creating up to 50% more living space for a two-storey house, improving space heating efficiency by 10% — based on 2005 SAP calculations — and increasing the density of housebuilding without using more land.

The report also gives details of basement types and construction techniques, together with costings and references to legislation.

The addition of a basement can provide extra credits under the Code for Sustainable Homes — for example, with the potential reduction in the size of a building's footprint or the availability of storage space for recycling, bicycles or alternative fuel supplies.

The design and performance of housing in the UK is currently undergoing a radical re-evaluation as a result of legislation and changing attitudes towards sustainability and energy efficiency. The reintroduction of basements to new-build housing could help address these issues, while providing more flexible living space.

Basements for Housing is available as a free download from www.concretecentre.com



This new publication highlights benefits of building underground.

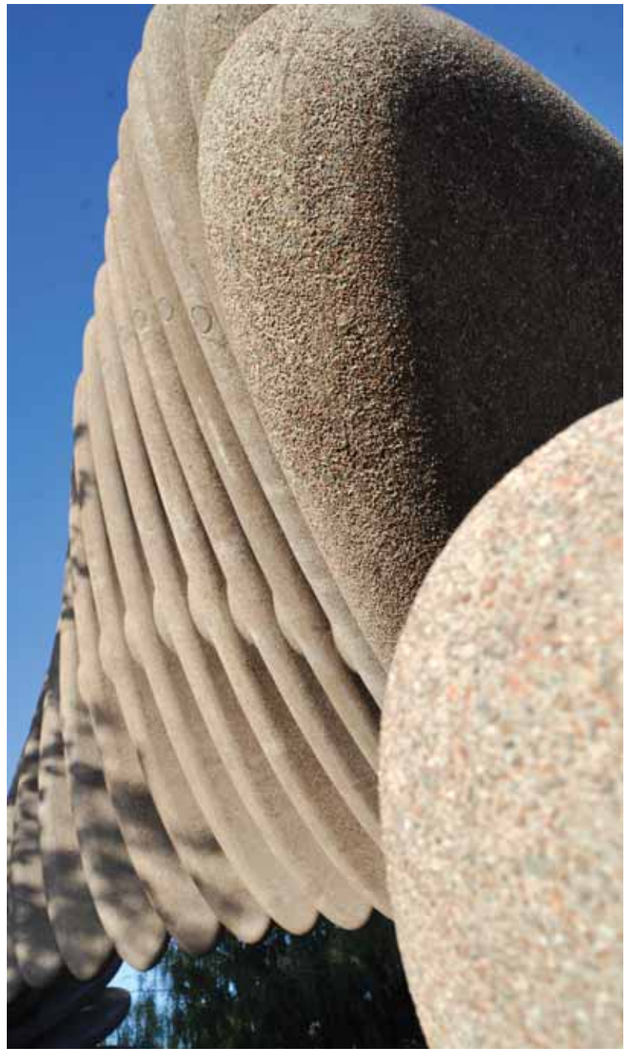
New thermal properties tool launched at Ecobuild

A new tool for calculating the thermal properties of floors and walls was launched by The Concrete Centre at this year's Ecobuild conference at the beginning of March in Earls Court, London.

The tool will support the 2010 introduction of thermal mass in SAP, the Government's Standard Assessment Procedure for the energy rating of dwellings.

SAP forms part of the UK's methodology for calculating the energy performance of buildings, and for demonstrating compliance with Part L1 of the Building Regulations. Developed in partnership with Arup, the tool will help designers to assess and optimise thermal mass and calculate a building's performance in both summer and winter. A document, SAP 2009 Fabric Energy and Efficiency Thermal Mass, shows the values for elements calculated using the tool.

For further information visit: www.concretecentre.com



Darwin memorial evolves in Shrewsbury

To mark the bicentenary of Charles Darwin's death, Pearce & Lal has designed a sculpture entitled Quantum Leap for Mardol Quay Gardens in Shrewsbury, Darwin's birthplace.

Standing 12m high and 17.5m long, and weighing more than 100 tonnes, the precast concrete work is the UK's second-largest sculpture. It represents Darwin's groundbreaking scientific ideas and has been likened to a shell, human vertebrae, DNA and a dinosaur.

The design was created by Ranbir Lal on behalf of Pearce & Lal, with Aggregate Industries and Charcon Precast Solutions providing the technical expertise and materials. Both companies supported the project as a charity donation. The timber moulds alone took more than 400 hours to construct.

The project demanded complex reinforcement. Each of the 31 handcrafted 3.5-tonne propeller-shaped blades had to be inserted onto a temporary hoist system and then turned 5.625 degrees to reach their final positions, forming a rigid arch.

The manufacturing of the precast blades also required specific concrete mix designs and careful vibration control. The moulds had a tapered and twisted form that needed over 200 cross-section dimensions per blade to ensure an equal and symmetrical camber on both sides of the central axis point.

Ranbir Lal's 12m-high, 100-tonne precast concrete sculpture is the second-largest in the UK.

Concrete companies take the lead in responsible sourcing

The concrete sector is taking the lead over other construction material sectors in responsible sourcing. Several major concrete companies have already gained accreditation to BES 6001 Framework Standard for the Responsible Sourcing of Construction Products, and more are to follow.

Aggregate Industries, Lafarge, Cemex, Hanson and Tarmac have all gained accreditation to BES 6001.

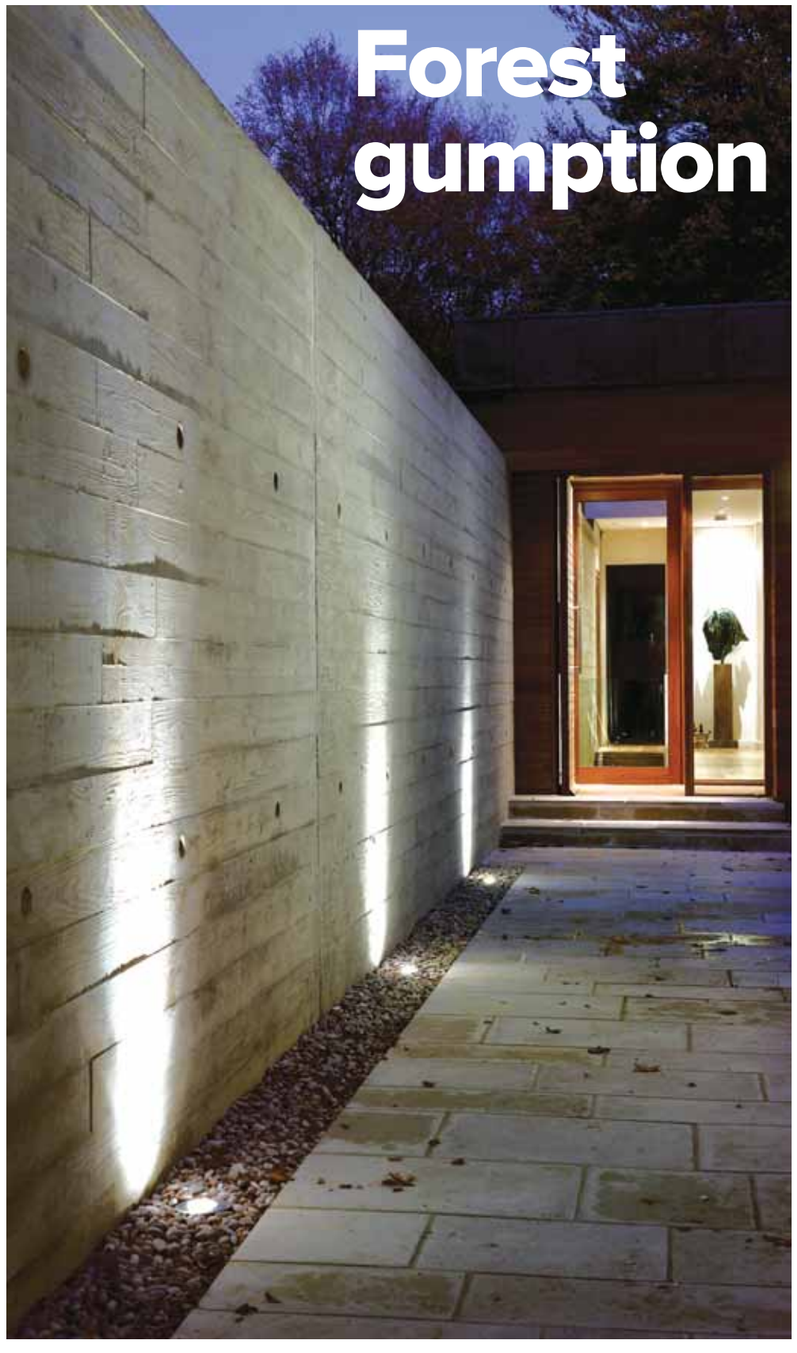
The responsible sourcing of construction materials has been part of the materials section of BREEAM and the Code for Sustainable Homes schemes since inception.

In 2008, the Building Research Establishment (BRE) launched BES 6001 to provide a common benchmark for the assessment of construction products. It expands the requirements well beyond those of existing schemes such as FSC (Forest Stewardship Council) certification.

Concrete can now gain maximum credits for responsible sourcing under these schemes. BES 6001 has integrated all the activities associated with responsible sourcing in the supply chain, together with their delivery mechanism using certified management systems.

As a key part of the Concrete Industry Sustainable Construction Strategy, a guidance document has been produced that supports the implementation of BES 6001. The concrete industry was the first to provide such guidance.

Forest gumption



Go down to the woods of the New Forest and you may come upon a surprise — a low energy house in a restricted site where bold concrete construction enabled planning and sustainability demands to be met

A client brief for a home that is contemporary, comfortable and sustainable has its own special requirements. When you add the planning restrictions that come with building at a Site of Special Scientific Interest in the New Forest National Park in Hampshire, then you know you have a challenge. However, it is one that Perring Architecture & Design has met with sensitivity at its New Forest Low Energy House.

The massing, form and orientation of the house have been carefully conceived to ensure minimum impact on the ancient woodland site. The main house and guest annexe take the form of simple timber boxes that echo each other. They are linked by a concrete spine wall that vertically connects the ground with the basement.

To maximise the sense of space the bedrooms are on the ground floor, together with a generous open-plan living, dining and kitchen area. This features a glazed corner that completely opens up to remove the barriers between outside and inside.

Storage and ancillary areas are located in the basement. The basement proved key in providing the home with adequate space due to the restricted ground-floor space. The house has green roofs that are planted with sedum native to the UK.

The earth that was excavated to create the basement and the natural swimming pond was reused in the earth berm to the north of the spine wall, limiting the need to remove material from site. It also provides a visual screen to the north and acts as an acoustic buffer to nearby traffic noise.

The buildings are orientated to maximise solar gain — open to the south and closed to the north. They use groundsource heat pump technology,

solar thermal panels and log burners for heating and hot water requirements. Provision has been made at strategic points for the addition of photovoltaics. Based on SAP calculations, it is estimated that the house will have an annual CO_2 emission figure of only 5,700kg. This compares with the 15,600kg of CO_2 emitted by a typical UK house of the same size.

The decision to use concrete was reached in response to a combination of environmental, structural and aesthetic requirements. It provides a building with a high thermal mass that creates a stable internal temperature.

Visually, and in terms of performance, the use of concrete enabled the different demands of the project to be addressed. Perring saw this as an opportunity to explore the materiality and aesthetic potential of concrete.

New Forest Douglas fir, which was locally sourced from within two miles of the site, was used to form the shuttering panels for the board-marked spine wall. Much attention was paid to samples of wood and to the various textures that could be achieved using different cutting blades. This research was essential to achieve the required relief on the finished concrete.

To minimise wastage the formwork was reused throughout. Larger areas were poured first and then the formwork was cut down for smaller panels and return walls. After the spine wall was completed, the formwork was cleaned and used to clad the interior of the workshop.

The same amount of research went into ensuring the consistent colour and quality of the concrete. Many buildings were visited to examine the material's colour and textural possibilities. A finish specification for the concrete and consistent mix were then developed.

Opposite
A concrete spine wall runs through the property linking the two buildings.
Top
Glazed doors to the living area retract to open up the house.
Above
One of the ground-floor bedrooms.
Left
Acrylic-treated shuttering achieved the best concrete colour and timber relief.

The concrete subcontractor was fully engaged with the need for a high-quality finish. Early in the construction, a sample panel of the board-marked concrete was poured in order to review the tie bolt positions and concrete colour, and to determine how best to treat the Douglas fir boards to achieve the desired timber relief.

One half of the boards in the sample panel were treated with acrylic and the other half with water. Although similar in appearance, the acrylic treatment picked up more of the colour from the shuttering and had slightly more timber relief. While, initially, this was more work for the contractor, the decision to go with the acrylic treatment ultimately involved less work between pours. The shuttering behaved more consistently and was not subject to the same degree of shrinkage as the water-treated boards.

The research and attention to detail has paid dividends. The house's design, orientation and sustainability ensures that it sits comfortably within its woodland setting. The choice and quality of the construction materials further complements this setting to provide a home that is a real forest retreat.

PROJECT TEAM
Client: Private
Architect: Perring Architecture & Design
Structural engineer: Andrew Waring Associates
Concrete consultant: David Bennett Associates
Concrete contractor: Farncombe Construction
Main contractor: HA & DB Kitchin
Landscape architect: Anglo Pools

Foster Wilson Architects | **Cheltenham**

Concrete in the round

Cheltenham Ladies' College has a new arts centre that blends concrete curves with classical architecture

The Parabola Arts Centre, designed by Foster Wilson Architects, provides a performing arts space for both the students of Cheltenham Ladies' College and the local community.

The new 325-seat theatre is linked to a refurbished grade II* listed villa that provides foyers, backstage areas and teaching spaces. The flexible design of the theatre allows various stage layouts, with or without an orchestral pit.

Located opposite the entrance of the college, and in a conservation area, the building employs several visual devices and treatments to ensure it sits successfully within its context. Its oval shape reduces the perceived mass of its presence within the streetscape, while the curve of the walls is articulated in a classical language to reflect the character and proportions of the annexed villa. The external walls are constructed from the Bath stone that is so prevalent in Cheltenham.

The building uses the thermal mass of the exposed concrete frame and the internal fair-faced brickwork walls as part of its energy efficiency strategy, which employs natural ventilation.

Top
The arts centre's distinctive oval shape.
Above
Tradition meets modernity inside the theatre, which features exposed concrete and fair-faced brickwork.

Fresh air is drawn in through a large plenum in the basement and leaves through mechanised flaps at roof level.

The triple-height performance space is supported by slender, 225mm-diameter concrete columns with a 200mm-thick reinforced concrete proscenium arch in fair-faced concrete, which supports a large amount of equipment.

Exposed concrete was used for the soffit of the balconies, which incorporate rebated joints and are sloped to provide a thin edge. All of the exposed concrete was cast to a class C fair-faced specification, with pulverised fly ash as an additional cementitious material to obtain a dark grey colour. The internal fair-faced brickwork walls reference the other college buildings.

The arts centre brings contemporary design to the college with sensitivity. The use of exposed concrete not only provides the thermal mass required for the natural ventilation strategy, but also a freshness to its context.

PROJECT TEAM
Client: Cheltenham Ladies' College
Architect: Foster Wilson Architects
Structural engineer: Price & Myers
Main contractor:
Willmott Dixon Construction
Concrete contractor: GCM Contractors

CHELTENHAM PHOTOS: JAMES BRITTAIN

Richards Partington Architects | **Braintree**

Jolly green client

The new head office for Greenfields Community Housing in Essex demonstrates how sustainable performance can be integral to a building's design and use

The brief from Greenfields Community Housing was for a flexible head office in Braintree, Essex, that demonstrated and embodied the organisation's commitment to the environment.

Richards Partington Architects responded with a design approach that involved the complete integration of architecture, building systems and sustainability. Passive and active sustainable building systems were therefore fully incorporated into the building's design.

All of the cellular offices and meeting rooms are on the north elevation, between the build core and stairwell. Cross-ventilation is maintained by naturally ventilating the plenum above the cellular spaces with high-level windows on the north elevation and perforated panelling above the internal glazed partitions.

The building's in-situ concrete frame is an integral part of both its passive systems and office design. Exposed concrete soffits provide the thermal mass that radiates warmth in the winter and keeps the interior cool in the summer.

In periods of hot weather, the building's stored heat is purged using a night-time ventilation system in the raised floor. To reduce the embodied energy of the concrete, a 50% ground granulated blast furnace slag (GGBS) concrete mix was used.

Internal flexibility has been created by using a flat concrete slab within the 6m/7m x 6m structural grid. With no structural downloads, partitions can easily be installed on the soffit without obstructing the flow of air across the floor plate.

The introduction of a 25mm-deep, 1,200mm-diameter circular recess on the 1,500sq m planning grid provides a visual relief to the slab. The circular recesses were formed using plywood discs with chamfered edges fixed to the shuttering. The discs, and in particular their edges, were sealed to avoid damage and to protect the end grain from absorbing water as the concrete set in formwork.

Top
Passive and active sustainable systems were integral to the building's design.
Above
The recesses provide visual relief to the slab.
Left
Pendant lights hang from the circular recesses, which have a "fine smooth" finish.

Large circular pendant lights complement the relief by accentuating the subtle recesses.

A consistent "fine smooth" finish to the soffit was achieved by producing a series of trial panels and working closely with the concrete contractor.

In addition to the utilisation of the structure's thermal efficiency, the office has a large rainwater tank to store and recycle rainwater for flushing toilets and a ground-source heat pump that uses the earth's latent warmth to generate low-energy heating and cooling.

Greenfields Community Housing wanted a head office that made a sustainability statement, and Richards Partington has certainly delivered one, in which high sustainability credentials and an attractive working environment blend seamlessly.

PROJECT TEAM
Client:
Greenfields Community Housing
Architect:
Richards Partington Architects
Structural engineer:
Integral Structural Design
Main contractor: ISG Jackson
Concrete contractor: S & M Contractors

As good as its words

Derry's cultural centre for the Irish language draws on the symbols of Ireland's past to form a brave vision for the future, in concrete

By Graham Bizley

Walls have played an important part in the history of Derry. Its city wall, built in the early 17th century, remains intact despite several sieges, including one in 1689 that lasted 105 days. During the Troubles of the 20th century the blank gable walls of housing estates became canvases for highly charged political murals, which continue to be powerful symbols of the divisions in the city.

After 15 years of the peace process, investment has increased and cultural institutions are playing a large part in repairing perceived inequalities between the communities.

One such project is Cultúrlann Uí Chanáin, a cultural centre for the Irish language designed by Dublin-based O'Donnell & Tuomey Architects for An Gaeláras, the Irish-language arts and cultural organisation, which was completed in late 2009. Located in a conservation area, it features a 200-seat theatre, language classrooms, three incubation suites for local businesses, a youth club, café and bookshop.

Appropriately, the most striking feature of the building are its walls. On the street facade, folding planes of board-marked concrete frame an entrance porch that leads through into a courtyard defined by towering planes of concrete, washed with cool north light from a window high above.

Opposite
The robust, board-marked concrete interior atrium is flooded with north light from overhead.
Below
The Cultúrlann's narrow facade on Great James Street belies the vast presence of the building experienced from inside.

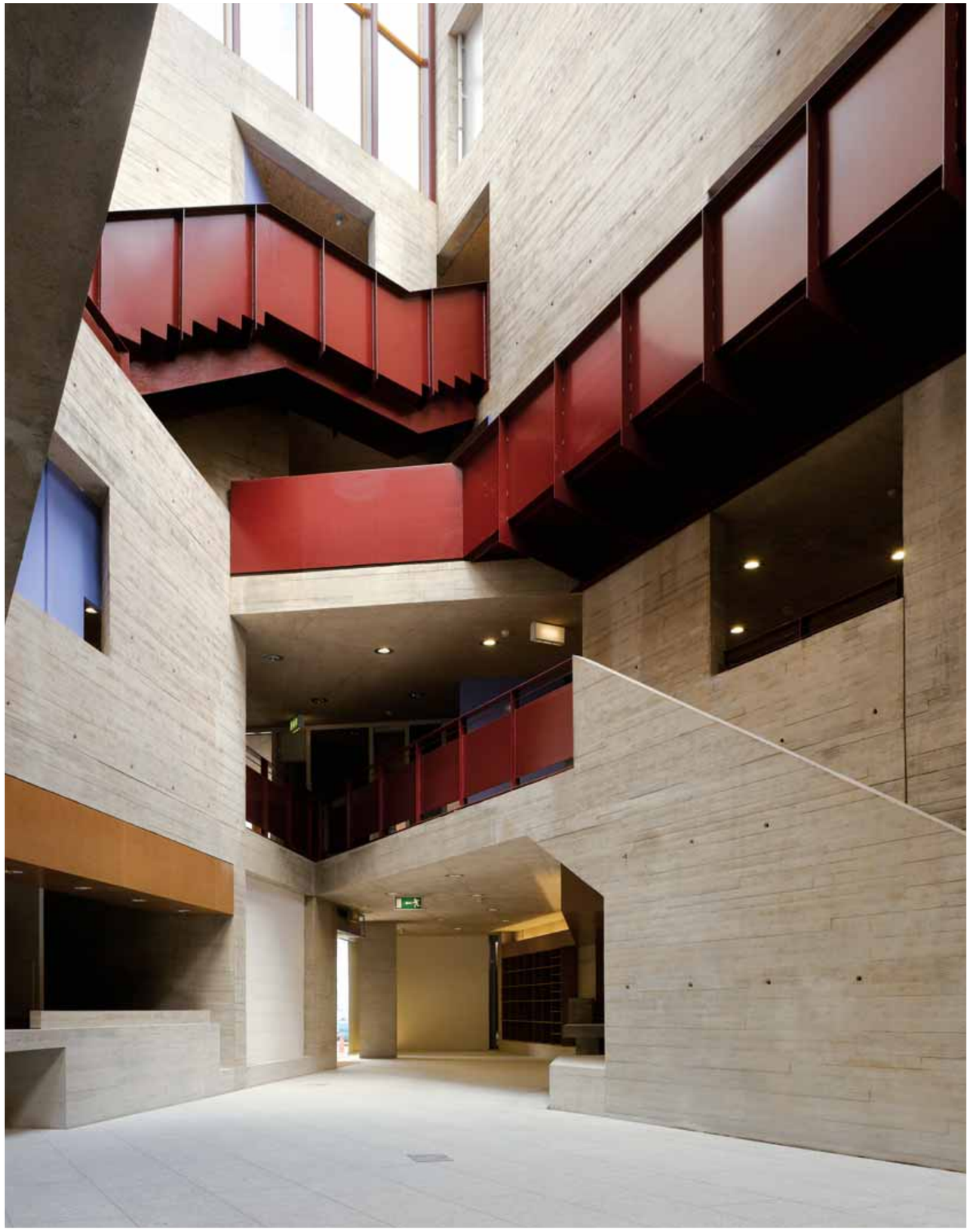
The plot is 50m deep but only has a 15m street frontage, part of which is taken up by an electrical substation. The courtyard has therefore become the heart of the building, which the various elements of the programme address. At ground floor a café is tucked into an undercroft off the courtyard that leads through to a performance space at the rear. A twisting route rises up a concrete staircase to the business units on the first floor, teaching rooms on the second and staff spaces on the third.

The courtyard is not a polite space like a conventional theatre foyer. You might expect a more tactile feel to elements, such as balustrades or the reception desk, but these have the same robust qualities as the walls. The reception desk and café counter have been cast in situ with polished concrete top surfaces. Walkways and staircases on the upper floors are made from 12mm mild steel plate, welded on site and painted with red oxide primer so that they feel like pieces of a ship. Their solidity gives the courtyard a presence reminiscent of the Norman tower houses that dot the Irish countryside.

Concrete is the dominant material, marked with a pattern of 75mm boards, which were fixed to the plywood formwork wherever it would be visible. Externally the board marks relate to the grain of neighbouring brick buildings but internally they give the walls a rich texture and a sense of the process of their making.

The boards were planed to varying thicknesses to enhance the texture and then fixed in the order they came off the pallet to ensure a random pattern. The edges of each board had to be chamfered slightly if the step was greater than 2mm so the formwork could be struck without damage. To get the full impression of the wood grain the boards were not sealed, which meant they had to be kept wet to prevent shrinkage.

The contractor, JPM Contracts from nearby Dungiven, did not have previous experience of such high-quality concrete construction, yet has achieved spectacular results. The concrete mix is standard C3/A ▶

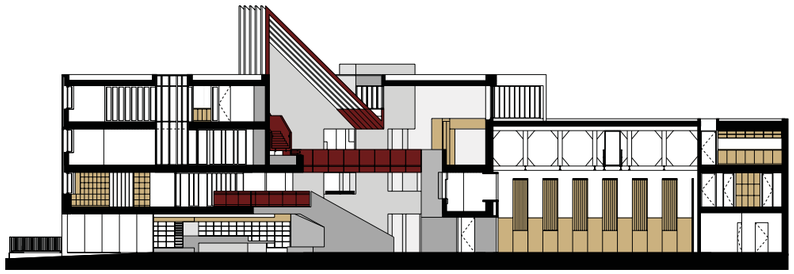


PHOTOS: DENIS GILBERT/VIEW

but with 50% ground granulated blast furnace slag (GGBS) used as additional cementitious material.

The structure is a hybrid of perimeter beams down the two long sides and several flat floor slabs cantilevering off the walls and columns. In the ground, combined bases were proposed to tie the different elements together and provide stability. Structural engineer Kieran Coyle of Albert Fry Associates says: "We soon realised that there would not be much site left so we joined them all together and cast a raft across the whole site." This minimised the potential for differential movement and vastly simplified the reinforcement and waterproofing details.

Derry's Cultúrlann is a bold statement of confidence in a multicultural community. Its walls are monumental and intensely crafted — symbols that might in time supersede the more graphic decoration of other walls in the city.



Above
Section through the Cultúrlann building, which sits on a 50m x 15m plot.

PROJECT TEAM
Architect: O'Donnell & Tuomey
Client: An Gaeláras
Structural engineer: Albert Fry Associates
Services engineer: IN2 Engineering Design Partnership
Main contractor: JPM Contracts
Quantity surveyor/project manager: Sammon Chartered Surveyors

Cultúrlann Uí Chanáin

The Cultúrlann is arranged around a top-lit internal courtyard from which the different functions are accessed by stairs, lobbies and walkways.

The concrete structure is exposed internally and on the street facade. Horizontal boards measuring 75mm were fixed to the plywood formwork to give the concrete a similar grain to the adjacent brick buildings. They vary in length and were planed to several different thicknesses to increase the depth of the pattern. On the ceilings the marks of the plywood shuttering were left visible and the soffits were lightly sandblasted. All of the internal concrete surfaces were sealed with two coats of matt dust sealant.

A 600mm-thick concrete raft foundation was cast over the whole site and the floor level was made up with hardcore. A poured grey terrazzo floor finish gives the courtyard an external feel.

From ground to first floor, the main staircase was cast in situ. A balustrade welded from 12mm steel plates runs along the first-floor landing. At second-floor level a steel walkway hangs off the concrete wall and a further steel staircase rises to the third floor.

The second-floor walkway is carried by tapered brackets at 1,125mm centres, which are bolted to a steel channel anchored into the concrete. Its underside has an intumescent paint finish and all the steel elements have been painted with red oxide primer.
Detail drawing by Graham Bizley

Cut-away section through staircase and walkway

1. Ground floor
1,217 x 517 x 16mm terrazzo cast in-situ.
25 x 16mm aluminium angle fixed to screed at all edges where terrazzo meets wall.
74mm powerfloated screed with underfloor heating pipes.
Polythene vapour barrier.
50mm rigid insulation.
200mm reinforced concrete floor slab.
30mm extruded polystyrene insulation.
Polythene DPM (damp-proof membrane).
50mm sand blinding.
920mm compacted hardcore.
600mm reinforced concrete raft foundation.
150mm oversite concrete.

2. Waterproofing below floor slab
Self-adhesive DPM bonded to vertical concrete walls.
Protection board between DPM and hardcore.

3. Waterproofing above floor slab
High performance DPC (damp-proof course) folded to allow for settlement, lapped 150mm over polythene DPM and fixed to wall with continuous 25 x 3mm plastic clamping strip.
6mm vertical protection board and 15mm vertical perimeter insulation between floor slab and DPC.

4. Internal wall
Reinforced concrete wall cast off raft slab.
Board-marked finish to all exposed faces.
Exposed surfaces sealed with clear matt concrete dust sealer.

5. First and second floors
75 x 19mm tongued-and-grooved character oak floor boards with sawn and brushed upper surface.
Floorboards sealed with white oil on all sides off site and with clear oil after laying.
170 x 45mm softwood joists at 400mm centres.
Polythene vapour barrier.
300mm reinforced concrete floor slab.
Underside of slab lightly sandblasted and sealed with clear matt concrete dust sealer.

6. Staircase
Min. 200mm thick reinforced concrete staircase cast in-situ.
1,100mm-wide x 300mm-deep x 170mm-high concrete steps.
50 x 5mm painted steel visual strips cast into treads.
300 x 356mm voids cast into wall for recessed light fittings at every third tread.

7. Balustrade
100mm-thick reinforced concrete balustrade above stair level with board-marked finish on both sides.

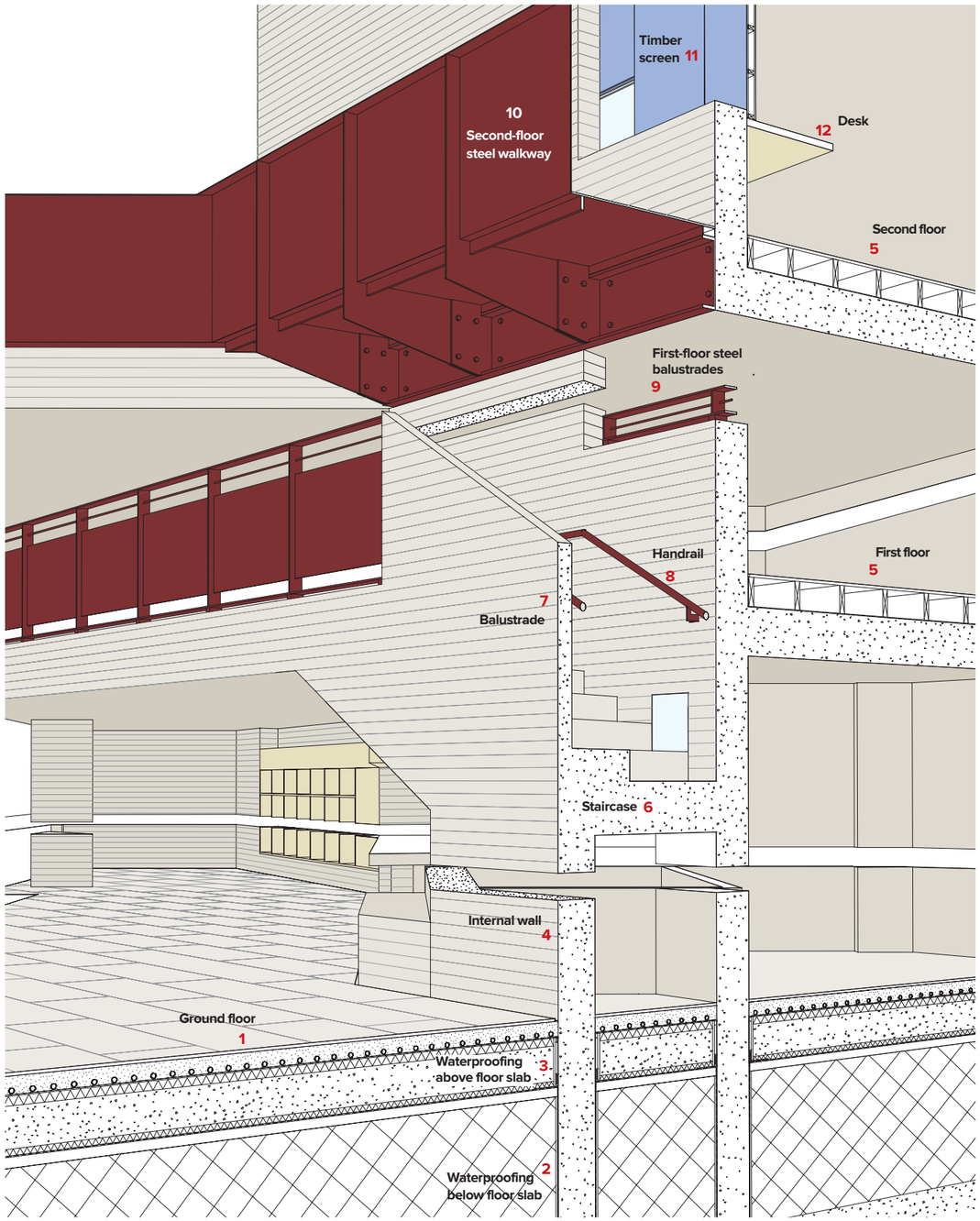
8. Handrail
40mm-diameter steel tube handrail bolted to wall with steel brackets.
Red oxide primer finish to all steelwork.

9. First-floor steel balustrades
100 x 12mm flat uprights at 1,160mm centres.
12mm plate infill panels welded to uprights (for full-height balustrades).
100 x 12mm flat top and bottom plates welded to uprights.
12mm diameter rod below top plate welded between uprights.
100 x 50 x 50mm solid bar supports welded to balustrade at 1,160mm centres and bolted down into concrete with chemical anchors.
Red oxide primer finish to all steelwork.

10. Second-floor steel walkway
430 x 100 x 64mm PFC (parallel flange channel) bolted to concrete wall.
100 x 55 x 3mm RHS (rolled hollow section) welded to top of PFC.
Pairs of 485 x 12mm steel plates welded into web of PFC at 1,125mm centres.
485 x 12mm cantilevering tapered beams with 100 x 12mm uprights bolted to brackets.
6mm balustrade plate folded over and welded to uprights.
10mm Durbar plate floor welded to beams.
75 x 20mm stiffening plate welded to underside of floor plate near leading edge.
Red oxide primer finish to all steelwork.

11. Timber screen
74mm-thick timber screen and opening panel made up from 50 x 25mm softwood studwork frames with 12mm MDF facings to both sides.
Hardwood lippings to all exposed edges.
8mm laminated glass windows.
20 x 20mm hardwood glazing beads flush with MDF facings.
Paint finish to all timber screens.

12. Desk
44mm solid white oak top.



Olympic legacies

With the structures for the London 2012 Olympics taking shape, CQ examines the impact and longevity of Italian designer Pier Luigi Nervi's stadia in Rome

By Manuel Cresciani

By 1960 Italian engineer and designer Pier Luigi Nervi had reached the apex of his career. Through his designs since the early 1930s, he had demonstrated the possible synchronicity between aesthetics and structure.

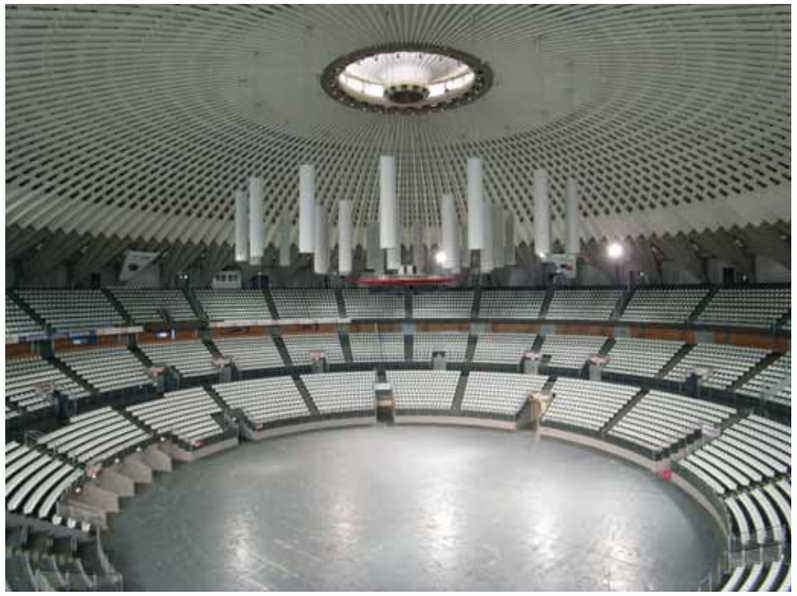
Just after the Second World War, he conceived and patented a lighter form of reinforced concrete, *ferro-cemento*, which could be made into any shape. It also allowed for fast and economical construction because formwork was not required.

By the late 1940s, Nervi was using this pre-fabricated concrete as a standard technology in his own practice. Quality control and construction speed were the two constant key elements in his design process. Nervi became an internationally recognised concrete designer and, by the end of the 1950s, had established himself as a masterbuilder of the 20th century.

The Italian Olympic Committee (CONI) gave him the task of designing functional and iconic sports venues for the 1960 Summer Olympics in Rome. Nervi responded with what was to become the manifesto of his entire production, the Palazzetto dello Sport, and two more buildings: the Palazzo dello Sport, also known as the Palaeur, which had the largest dome in reinforced concrete of its day with a 120m diameter; and the Stadio Flaminio, which he designed in collaboration with his eldest son, Antonio.

The Palazzetto dello Sport has been refurbished over the years, mainly to adhere to legislature changes and security regulations that are now required at large sporting events. For the 1990 FIFA World Cup, the extrados of the dome was painted blue and, after many complaints, was then restored to its original grey colour.

Plastic seats were also installed — the original building had no numbered seats — which reduced the overall capacity from 5,000 to 3,500 spectators. However, the main structure of the building is intact, and no damage or deformation is visible.



Above
The Palaeur has been adapted by owner All Events with the addition of an acoustic system at the intrados of the dome and politically neutral white seats.

Minor maintenance works have been carried out and a coloured sun screen was attached to the south elevation. The arena is still owned and managed by CONI and it is on the architectural tour map of many students and scholars.

Palaeur modernised

The Palaeur has withstood similar interventions. In 1991 a huge information panel for sports matches, weighing 50 tonnes, was hung from its dome. This system could be raised and lowered for maintenance. This movement, however, created vibrations within the dome and subsequent superficial damage. The Provincia di Roma, the owner at the time, responded by removing the panel.

In 2004, a private company called All Events took over the management of the Palaeur and modernised the sports hall. Due to the increasing use of the building as a venue for music concerts, a new acoustic system has been placed at the intrados of the dome, alongside other refurbishments.

Nervi patented a lighter form of reinforced concrete, ferro-cemento, which could be made into any shape

This system comprises a series of inverted foldable umbrellas that are opened before the events and closed afterwards. Mario Desideri, one of the engineers who worked with Nervi on the original design, was a structural consultant on this project.

All Events also replaced the original seats with neutral white ones to be sensitive to the venue's occasional hosting of large political assemblies and conferences. Minor works were then executed to update the internal facilities to meet current health and safety and public security legislation.

All of the original ventilation and air conditioning plant still work perfectly at the Palaeur, which, together with the Palazzetto, is the home ground of Rome's basketball and volleyball teams.

Stadio Flaminio most neglected

The Stadio Flaminio, however, has not been as well maintained. For many years, it has been the most neglected of all of Nervi's sports buildings in Rome.

Despite some remedial work in 1982, several parts of the stadium, in particular the uncovered stands, were affected. Further remedial work was carried out in 2000, when the Flaminio became Italy's official rugby home ground for the Six Nations Championship. The stadium was given new emergency exit routes to meet safety standards, and the overall capacity was reduced from 35,000 to 24,000 spectators. This capacity proved to be too restricted for the Six Nations and, therefore, temporary external tubular structures are erected every year around the stadium to increase the number of seated supporters by 6,000. In January this year, architect Eloy Suarez proposed to the Italian Rugby Federation a feasibility project to almost double the capacity of the venue.

Top
The refurbished Palazzetto dello Sport.
Above
Remedial work has been done at Stadio Flaminio.

The resilience of Nervi's sports venues is the result of careful but visionary design — both in terms of spatial features and structural and material competencies. They are certainly a valid example for London 2012.

Manuel Cresciani is Programme Leader of Architectural Engineering at the University of Leeds.

■ Nervi's buildings were reviewed in Concrete Quarterly in 1957 and 1959 (issues 34 and 42). Visit the CQ archive at www.concretecentre.com/cq

Precast visual check-in

The sparkling precast cladding of the new Hilton Hotel at Liverpool One creates a sharp geometric crispness

The new 215-bedroom Hilton Hotel is a prominent landmark and gateway to the Liverpool One Paradise Project, a £920 million scheme on the River Mersey waterfront.

The 10-storey hotel, which was designed by Aedas and features three-storeys of residential flats at the top, echoes the 19th century classical architecture of the city. A double-height colonnade runs the length of the north elevation. The building curves with a regular rhythm of white precast panels and solar control glass on the north and south elevations.

Above and left
A double-height colonnade runs the length of the north elevation.

The formality of this rhythm is challenged by the freedom of the east and west facades, which feature irregularly spaced, structural white precast concrete fins. These provide deep shading for the structural glazing that is set back from the facade. This design approach is also repeated across the top three storeys.

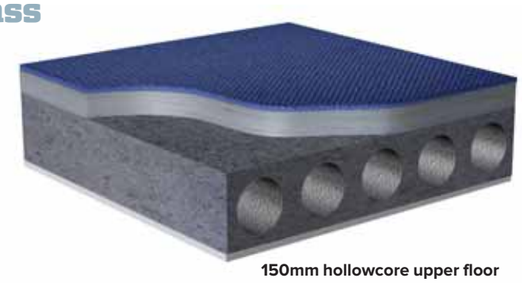
The hotel was constructed with an in-situ concrete frame from the ground to the second floor. From here to the roof, the structure comprises crosswall precast concrete panels that form the walls and floors. The load-bearing walls provide the necessary vertical support and lateral stability and the stair cores create rigidity.

The sharp lines of the design are accentuated by the white precast cladding supplied by Trent Concrete. The building is covered with more than 6,500sq m of reconstructed white Portland stone cladding, which has a brilliant white Spanish Dolomite finish for that extra visual brio.

Furthermore, to prove that precast construction has structural, as well as visual credentials, on the gable ends of the side elevations, structural precast columns and beams provide extra stability.

PROJECT TEAM
Client: Grosvenor
Architect: Aedas Architects
Main contractor: Kier Build
Precast concrete: Trent Concrete

Thermal mass key to zero carbon buildings



150mm hollowcore upper floor (carpeted screed, wet plaster soffit) K-value: 120 kJ/m²K from above, 160 kJ/m²K from below.

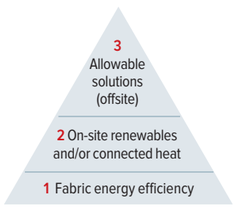
The benefits of thermal mass are undisputed, but a recent shift from being 'beneficial, but not essential' towards becoming part of the solution for low- and zero-carbon buildings can be seen in proposed changes to the Building Regulations and a new fabric performance standard for housing

Tom De Saulles

Scarcely a month goes by without a new consultation or draft standard aimed at minimising CO_2 emissions from buildings. Encouragingly, a common approach has appeared, suggesting joined up thinking at government level.

This is characterised by a simple three-tier approach to cutting emissions, which starts by maximising fabric performance, before then considering on-site renewable technologies and finally, offsite solutions to make up any shortfall in hitting CO_2 targets. This recognises the importance of making the fabric work to secure long lasting performance benefits, which in turn minimises the need for expensive, less durable bolt-on technologies.

In addressing fabric energy efficiency, it's recognised that this is no longer a question of simply adding more insulation. Interestingly, the ability to save energy using the thermal mass in heavyweight materials like concrete, actually increases as insulation levels go up.



The new fabric energy efficiency standard for zero carbon homes deals with stage one of the three-tier approach to cutting CO_2 emissions.

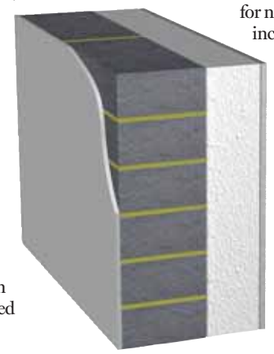
The way in which thermal mass can contribute to fabric energy efficiency is through its ability to store and release free heat gains from the winter sun and internal appliances etc., helping reduce the fuel used by heating systems. The thermal capacity of heavyweight buildings makes them more effective at doing this than lightweight structures, and the difference in performance is now accounted for in draft revisions to the energy assessment tool (SAP) which supports Part L1 of the Building Regulations.

The extent to which thermal mass can save heating energy in homes is dependent on a number of factors, particularly the:

- overall level of dwelling insulation and air tightness (higher the better)
- boiler and heating controls (high efficiency systems will maximise the benefits of thermal mass)
- window size and orientation (glazing on elevations with a southerly aspect should ideally be optimised).

Actual savings will vary from one project to another and also in response to the factors highlighted above. For a modestly insulated detached property with a basic heating system, a high level of thermal mass may provide little or no benefit during the heating season. In contrast, highly insulated homes with efficient heating can reduce their space heating requirement by up to 40% or more compared to an equivalent low mass dwelling (based on draft SAP 2009). To put this in context, this is roughly equivalent to the emissions that would be saved by adding about 2sq m of solar panels to a well insulted, energy efficient, semi-detached house.

Diagrams above and below
Examples of thermal mass K-values produced by the new Arup/Concrete Centre tool using draft SAP 2009.



Dense aggregate block wall (215mm), wet plaster finish K-value =190 kJ/m²K

Whilst the role of thermal mass during the heating season is receiving new attention, its summertime passive cooling ability continues to be an important driver for heavyweight construction. This is likely to increase as the government's focus widens to include climate change adaptation alongside current mitigation measures. For example, proposed changes to Part L2 of the Building Regulations include limits on solar gain in non-domestic buildings which, alongside other revisions, will make air conditioning a less attractive option and should encourage a more passive approach. This is complemented by an anticipated revision to the British Council for Offices (BCO) specification, which will relax the maximum internal temperature. For housing, the overheating check for new housing has also been revised and includes new weather data, increasing the need to make effective use of ventilation, shading and thermal mass to avoid overheating problems.

- **K-value is the new measure of thermal mass in SAP/Part L1 Building Regulations.**
- **Download "SAP 2009 – Fabric energy efficiency and thermal mass" from www.concretecentre.com**

Retro concrete

Concrete Quarterly was first published in 1947. Since then, CQ has covered many iconic concrete projects. Journey back in time, whether for nostalgia or inspiration, by visiting the archive of Concrete Quarterly at www.concretecentre.com/cq

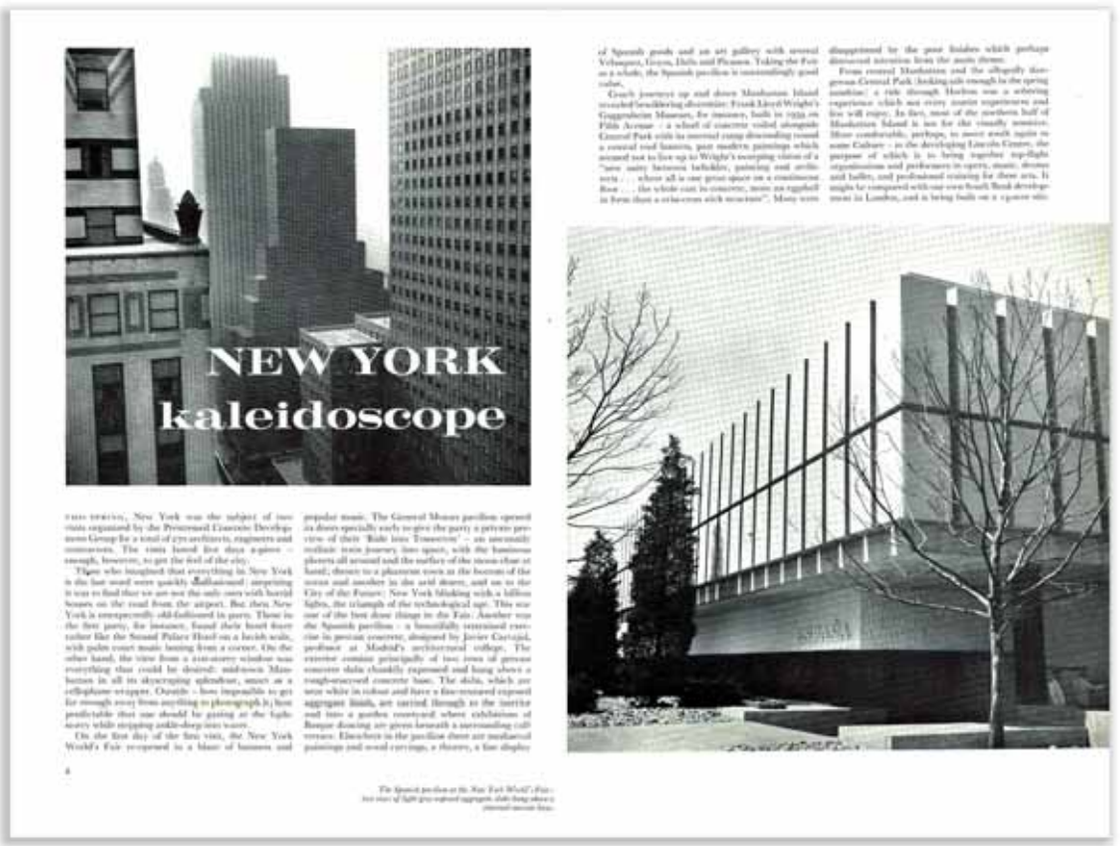
A bite of the Big Apple

For those of you not able to get enough of the sharp-suited glamour of downtown 1960s Manhattan, as shown in the TV series Mad Men, CQ has already been there and written the postcard.

An article in CQ's Summer 1965 issue, "New York Kaleidoscope", covers a five-day architectural tour. One of the highlights was visiting the Spanish Pavilion at the New York World's Fair. Designed by Javier Carvajal, it is an exercise in elegant precast concrete.

Also visited were Eero Saarinen's Columbia Broadcasting System building, Mies van der Rohe's Seagram Building and the Lincoln Center for the Performing Arts, which at the time was under construction.

■ **To revisit the Summer 1965 issue of Concrete Quarterly, go to www.concretecentre.com/cq**



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