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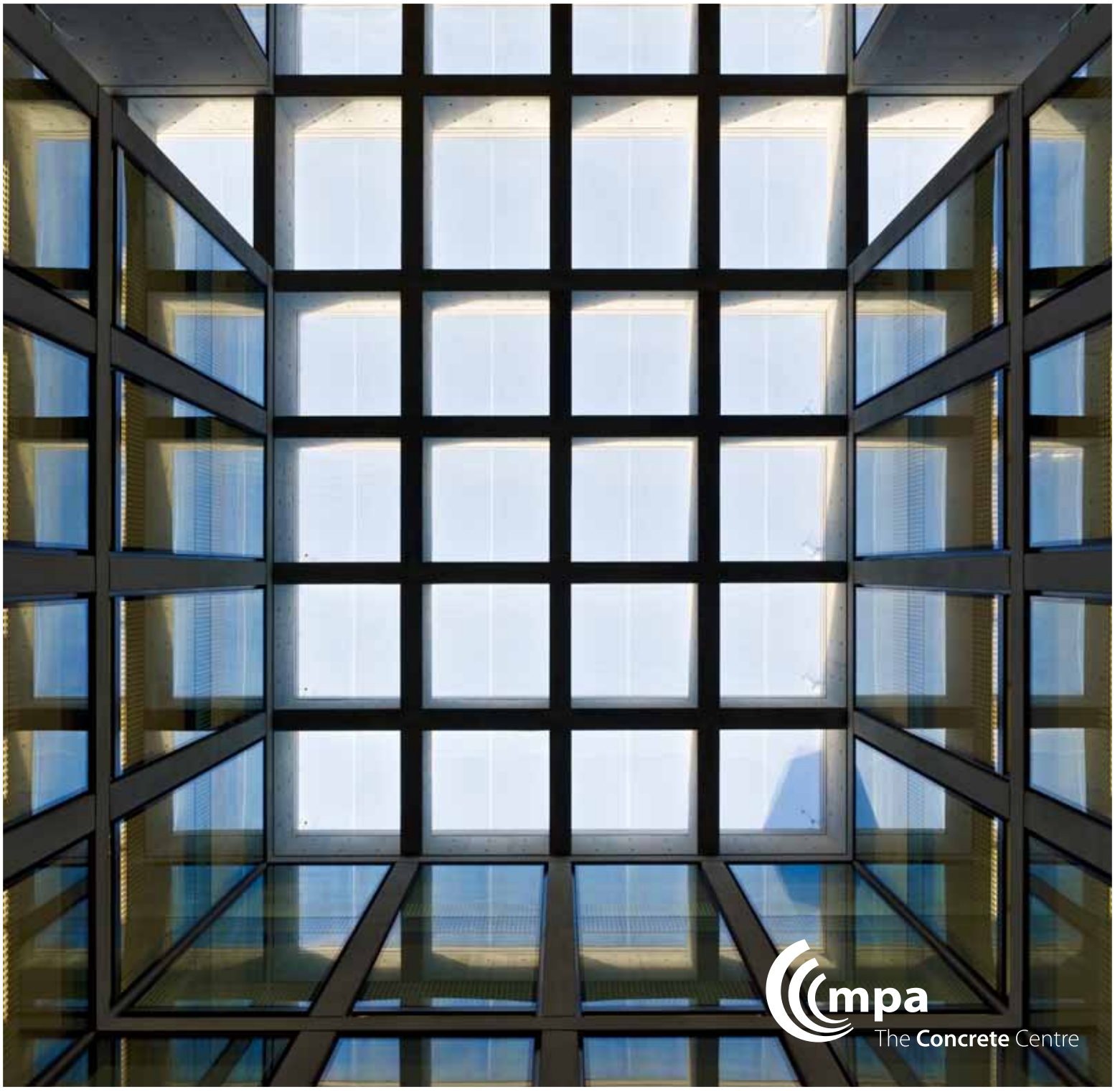
HEAVENLY FEATURES
Exposed concrete, a curving facade and a retractable roof have transformed Islington's unloved Angel Building

WHAT LIES BENEATH
A new public square outside Bristol's civil justice centre takes its cue from millions of years of geological history

THE NEW BOY
Pie Architecture's robust extension has made quite an impression on a Catholic primary school in north London



HAVING IT BOTH WAYS

Can architecture be both glamorous and worthy? That might sound like a contradiction in terms, but our cover star demonstrates that, with innovative use of concrete construction, buildings can achieve the apparently impossible.

The Angel Building in north London (page 4) combines inspirational design with impeccable sustainable credentials. Exposed concrete plays a central role in turning what was a non-descript office block into one that has both a "wow" factor and a low carbon footprint. Similarly, the sparkling white cut-out facade of CitySpace at the University of Sunderland (page 9) makes a bold visual statement while its thermal mass contributes towards an "excellent" BREEAM rating.

Concrete design is not always about the monumental. It can also be understated. For St Joseph's Roman Catholic School in north London (page 10) concrete shapes introduce a new architectural arithmetic with muted tones that discreetly update the building's existing vocabulary.

Not content to rest upon these laurels, the concrete sector is pursuing a sustainability agenda that has been applauded by the construction industry and government. Its objective is simple: to be recognised as the leader in sustainable construction. The publication of our latest report detailing the achievement of key sustainability targets (right) demonstrates pan-industry progress – and proves that glamour and worthiness are not so far apart after all.

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

INSIDE

On the cover: AHMM's Angel Building in Islington, north London

The Concrete Centre is part of the Mineral Products Association, the trade association for the aggregates, asphalt, cement, concrete, lime, mortar and silica sand industries. www.mineralproducts.org

Concrete Centre flies the flag for eco construction

The Concrete Centre will be promoting concrete's wide range of environmental credentials at Ecobuild from 1 to 3 March at the ExCeL centre in London's Docklands.

The overall theme of The Concrete Centre stand is holistic whole-life sustainability and it will include information on responsible sourcing and achieving zero-carbon construction. A number of low-carbon project case studies will be presented and full technical advice and guidance will be available.

All this and more can be found at stand N1161 of the exhibition hall.

In addition, The Concrete Centre will be presenting at a number of fringe events during the exhibition. These include:

■ **Can we achieve better buildings through building physics?**
Tuesday 1 March, 12.30
South Gallery 27

■ **Understanding embodied carbon in products and materials**
Wednesday 2 March, 10.30
North Gallery 4 and 5

■ **Achieving zero-carbon homes: Optimising fabric and energy performance**
Wednesday 2 March, 15.00
South Gallery 29

■ **Passivhaus and concrete construction**
Thursday 3 March, 13.30
North Gallery 9

Guide explains concrete benefits

The Concrete Centre has published a new guide to the numerous sustainability benefits of concrete and masonry housing.

"Fabric for the Future" provides details of a range of benefits for design and construction, both in use and from a whole-life perspective.

Benefits include the potential to responsibly source materials, thermal mass – which capitalises on passive solar benefits and reduces overheating – and flexibility in terms of re-use and recycling.

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

Marine Crescent, Folkestone, built in 1870: Proof of the natural durability of concrete

Minister praises sector's progress on sustainability

The concrete industry has been praised by Mark Prisk, minister for construction, for its environmental credentials and commitment to sustainability at the parliamentary launch of the annual Concrete Sustainability Performance Report.

Prisk said: "I am really impressed by how the concrete industry has taken positive action and initiative, not only to reduce carbon emissions, but also to produce cleaner products and reduce waste. This last achievement is one that the industry should take particular pride in, for it now uses more waste than it produces."

Paul Morrell, the government's chief construction adviser, also applauded the concrete industry for having taken the initiative in developing a vision of leadership for sustainable construction. However, he said that while there is excellence in sustainability to be found both in the concrete industry and in a number of exemplar sustainable buildings, the construction industry generally is fragmented: "It is inconceivable that we can solve these problems [of low-carbon construction] if we continue to work in silos."

THE INDUSTRY SHOULD TAKE PARTICULAR PRIDE IN THE FACT THAT IT NOW USES MORE WASTE THAN IT PRODUCES

MARK PRISK

Prisk: Impressed with 'positive action' on producing cleaner products

Morrell also focused on the importance of examining the whole-life performance of buildings and of developing assessment tools that enable carbon to be used as a metric for good decision-making. For example, products cannot be properly compared if the impact of transportation is ignored, he said.

Morrell encouraged the concrete industry to engage with the government's own agenda when it responds, in the spring, to his November 2010 report on the ability of the construction industry to deliver a low-carbon future.

This is the third Sustainable Concrete Forum report following the agreement between the nine sectors within the concrete industry to commit to a pan-industry sustainability strategy, with the aim that, by 2012, the industry will be recognised as the leader in sustainable construction. It intends to achieve this by adopting a dynamic role in delivering a sustainable built environment in a manner that is profitable, socially responsible, and functions within environmental limits.

To download a copy of the latest Concrete Industry Sustainability Performance Report, visit www.sustainableconcrete.org.uk

Laing O'Rourke buys into cement alternative

Contractor Laing O'Rourke has joined investors in carbon-negative cement company Novacem in a round of fundraising worth £1.6m. This fund will be used to continue the development of the product and expand its commercial potential.

Novacem's carbon-negative cement is based on magnesium oxide and offers the cement industry a scalable alternative to current production. No carbon emissions are released from the magnesium silicate raw material.

Overall, the production process to make one tonne of Novacem cement absorbs up to 100kg more CO_2 than it emits.

The product is based on 20 years of research on the mineral carbonation of magnesium silicates. These minerals are widely dispersed with accessible worldwide reserves estimated to exceed 10,000 billion tonnes.

Laing O'Rourke previously collaborated with Novacem in a two-year project worth £1.5m, funded by the Technology Strategy Board, and the two companies are planning further joint development activities.

To find out more, go to www.novacem.com

The Novacem product is based on magnesium oxide

Low-carbon housing series published

A new guidance series, "Building Low Carbon Homes", has been published by Zero Carbon Hub. Three guides are now available to download: "Masonry", "Concrete Frame" and "Insulating Concrete Formwork (ICF)".

Each guide provides comprehensive information on key issues including thermal performance, bridging and bypass, airtightness and sequencing, together with a range of key working details. In addition, each has a case study to demonstrate the theory in practice.

To download free copies of the "Building Low Carbon Homes" series, visit www.concretecentre.com/publications

AN ANGEL REBORN

An unloved eighties office building in north London has been stripped back to its concrete frame and transformed by AHMM into a cool high-tech workplace fit for the 21st century. Tony Whitehead reports

When developer Derwent London merged with LMS in 2007, it inherited a large, unloved office building. Built in 1980, when suitcase-sized fax machines were the latest thing, five-storey Angel Place featured a brown granite and smoked glass facade. At the time, in the rundown London borough of Islington, it probably seemed stylish and futuristic – but it is not a look that has aged well. Around Angel Place, Islington was on the up, becoming by the early nineties the kind of place where future prime ministers would map out their careers in trendy bistros. Meanwhile, behind the mirror glass, the interior functionality of Angel Place struggled to keep its 21st-century occupiers happy. Tenant BT quit the building years before its lease was up.

So what to do? Demolish and rebuild seemed the obvious option. But then Derwent and architect Allford Hall Monaghan Morris (AHMM) looked again at the building's potential and came up with a plan to re-use Angel Place's substantial concrete frame, while creating a much larger lettable area.

The result is a development of considerable confidence. The new, £68m Angel Building boasts a dramatic, curved sweep of frontage, cool bare concrete interiors, and a stunning new atrium topped with an inflatable roof that can open on sunny days like a hot-hatch convertible. It has also been awarded a BREEAM rating of "excellent".

"Islington has changed a lot since the original building was completed," says Derwent's project manager David Thurston. "The site now demanded much higher quality." He says that, being more or less equidistant from the City and the West End, the site had to be developed with a range of occupiers in mind. "Either way, though, it had to be of very high spec to maximise its potential. We saw a fantastic opportunity to expand the floor area and enliven the centre of the building, and AHMM came up with an exciting vision of how it could work."

Thurston admits that the old building suffered from a very inefficient floorplan – its large courtyard being a particular waste of space. So why retain the concrete frame?

"Fundamentally, the decision was all about embodied energy," says Steve Smith, project architect with AHMM. "We take sustainability seriously so, once we realised that it would cost 2,000 tonnes of CO_2 to replace the frame, it became very difficult to do anything else."

He explains that embodied energy traditionally accounted for only 10% of the energy a building used during its lifetime. But with running costs driven down in more efficient buildings, that ratio is heading towards 50-50, making embodied energy a much weightier consideration.

But this wasn't the only advantage. Smith says: "Once we made the decision to keep the frame, we started appreciating the money saved by not having to rebuild it, and the benefits of knocking several months off the programme."

He admits that stripping back to the frame took time, and that the project could possibly have advanced quicker with a demolition followed by a steel frame. "But that wouldn't have worked at all with the environmental strategy we had for the building, which was heavily involved in making use of the thermal mass of a concrete frame."

TOP
A heavy concrete grid supports an ETFE roof, which can be retracted in hot weather

ABOVE
The use of in-situ concrete defines the aesthetic of the interior extensions

The new facade reinstates the curve of the street's original Victorian terrace

Finishing touch

Self-compacting concrete was used in the atrium and entrance areas

Altogether, contractor Getjar poured some 7,300m³ of concrete, around 1,800m³ of which was self-compacting.

John Croxford, Getjar's contracts manager, explains: "The self-compacting concrete was used for all the bare, visible concrete in the entrance and atrium area. Standard concrete requires agitating by operatives to remove voids, so self-compacting concrete, though more expensive, is often used where access is difficult. In this case, though, it was chosen for the very fine finish it can produce."

Croxford says that high-flowing admixtures cause self-compacting concrete to be much runnier than normal, enabling it reliably to fill every part of the formwork. Its comparative lack of air bubbles results in a smoother surface finish, but it has to be used carefully.

"Because this type of concrete does not begin to stiffen during a pour as standard concrete does, the formwork has to be able to support the full weight of the concrete as if it were water. This means formwork has to be heavier to prevent flexing. At Angel, we used a double thickness of ply which also enabled all nail and screw marks to be concealed in the outer layer."

The concrete also contains a relatively high amount (36%) of fly ash as a cement addition. "As it is a waste product, the use of fly ash helps with sustainability, but here it was also very important to achieve the right colour. AHMM wanted a very specific darkish grey, not the creamy colour of some concretes."

Croxford says the most challenging part of the job was the new entrance area, and the thin concrete elements designed to cover the steel frame extension. In the event however, Getjar's success in the atrium encouraged it to carry out in-situ concrete work to unusually fine tolerances. "In this area we were creating vertical panels 9m high but only 150mm wide so the only way to maintain consistent rebar cover was to place the reinforcement and formwork extremely accurately."

ABOVE
The use of fly ash creates concrete of a very dark grey

LEFT
A full-height atrium has been created out of the central courtyard

The new building has a lettable area of 265,000ft², a 63% improvement on the original. The three extensions to the building that help achieve this – two to the side and one inwards into the courtyard – do more than just add space, however. Smith says: "The old building was essentially a rectangular doughnut on plan, set back a long way from the street because of a previous plan to widen the road. That never happened, and the result was that the building had a very strange relationship with the street.

"So we have extended the building towards the street, at the same time putting back the long graceful curve of the original Victorian terrace."

The curved extension projects to a maximum of 10m from the original perimeter while a more straightforward extension projects 3m from the former south elevation.

However the greatest amount of added space was created by building into the 12,000ft² courtyard to create extra room on each floor as well as a full-height central atrium. And while the exterior additions have been achieved with a new steel frame fixed to the original concrete, this interior extension was constructed from in-situ concrete.

As Smith explains, it is this that defines the interior aesthetic. "What you see in the atrium is concrete surfaces and grids. At AHMM we are, if you like, old-fashioned modernists. It is the grid form that naturally results if you build in reinforced concrete, as demonstrated by le Corbusier's Dom-ino house [a standardised system developed in 1914-15]."

And it is impressive. The brutal bare concrete beams and columns make a very overt structural statement, and the lines and rectangles continue up and even over, with a heavy concrete grid supporting the transparent inflatable ETFE pillow atrium roof. It has a mid-20th century feel, but the

Photos: Tim Soar and Allford Hall Monaghan Morris

Green Angel

The high thermal mass of concrete frame buildings naturally acts as a "thermal flywheel", evening out diurnal temperature variations. At the Angel Building, this effect is boosted by the use of a low-energy displacement ventilation system.

Architect Steve Smith says that heat generated by the building's 3,000 occupants and their computers means that for most of the year the building requires cooling: "But even if the outside temperature is only a few degrees cooler than inside, sufficient cooling can be achieved by drawing in large volumes of air."

Four air-handling plants on the roof draw air down through risers and into the floor voids, which act as plenums. The concrete frame helps to cool the air before it is released into the occupied areas via floor diffusers. In hot weather, the air can also be cooled with chillers but with the frame then acting as a heat sink, this active cooling is kept to a minimum.

When heating is required, it is done via traditional trench radiators powered by a wood-chip boiler.

Insulation is high throughout, the aluminium cladding having a U-value of 1.5 W/m²K and the ETFE atrium roof having a value of 2.16W/m²K.

Solar gain is controlled without the use of brise-soleils by reflective glass and on hot days it is possible to open the atrium roof, although this feature is primarily designed to help with fire regulations and Smith admits it will have to await a hot summer for testing.

The building's sustainability credentials are topped off by a rainwater collection and re-use system, 150 cycle spaces, and a carefully selected variety of plants to supplement the site's existing mature plane trees.

ABOVE

The bare concrete beams and columns make an overt structural statement

PROJECT TEAM

Client Derwent London
Architect Allford Hall Monaghan Morris
Project manager Buro 4
Contractor Bam Construction
Concrete contractor Getjar
Structural engineer Adams Kara Taylor

quality of the 'as-struck' concrete finish ensures the Angel Building remains safe from comparisons with the worst of sixties architecture.

"The finish is very important," agrees Smith. "With the subcontractor, Getjar, we built a lot of mock-ups and tested various mixes from different local suppliers [see box, opposite page] and I think that really paid off: we are very happy with the result."

The in-situ concrete frame for the interior extension at Angel Building was effectively treated as a separate building, with its own piles and foundations. Smith says: "There's no need for any joints to be visible in the atrium. Putting the two structures together just means you need careful detailing across both to make sure everything aligns properly."

In order to ensure the cafe and lounge areas were column-free, the building uses a Vierendeel truss, designed by structural engineer Adams Kara Taylor to support the ceilings from above. The open space ensures these areas feel truly part of the atrium. "Too often the atrium is just dead space," says Smith, "somewhere you walk across to get to the lifts. But here there is a cafe and a lounge on the ground floor and at other levels there are meeting rooms and break-out spaces." The atrium has become "the busy heart of the building", he says – an apt metaphor for an office block that was spared demolition to be given an extraordinary new lease of life.

HIDDEN DEPTHS

A new public square in Bristol takes its inspiration from the layered effects found in the site's geological history

The plinths were manafactured as concrete boxes and in-filled with in-situ concrete on site

Public space design by Gillespies

PROJECT TEAM
Client Bristol Council
Landscape architect Gillespies
Artistic collaboration Tania Kovats
Precast concrete Concrete Bloc

The plaza makes a visual link between the new civil justice centre and the 14th-century Church of St Thomas the Martyr

Urban public spaces have to be many things. They need to reflect their setting, yet have their own identity. They need to be robust and require little maintenance, yet be inviting. They need to accommodate both movement and repose. Above all, they need to add to the urban experience. Redcliffe Street Plaza in Bristol manages to achieve all of the above.

Designed by landscape architect Gillespies, the plaza is framed by the red sandstone facade of the recently opened Bristol Civil Justice Centre and the Bath stone of the 14th-century tower of the Church of St Thomas the Martyr. The simple gestures of a 1:20 slope and a series of feathered steps take you from the entrance to the civil justice centre and from the church tower. This subtle delineation manages to reduce the bulk of the new centre while providing a raised platform for the church.

Gillespies could have left the design of the plaza at that, but instead it has given the space its own colour and character. The architect took as a starting point the horizontal stratum on quayside walls left by the ebb and flow of the adjacent River Avon. Working closely with artist Tania Kovats, it developed this into a narrative of geological evolution and formation.

The steps and raised edges of the plaza have coloured layers seemingly uncovered by the angled slope. The effect is that of exposing a piece of the Earth's crust. This analogy is carried forward by the natural palette of the layers and a series of scattered, slanted monolithic concrete plinths in the south-western corner that seem to push up through the crust of the plaza. The different sized plinths tilt towards and away from each other to create interesting shadows and spatial relationships. Practically, they also provide robust seating areas that are easy to maintain and clean.

The precise coloured layering on the precast concrete plinths is a tribute to the craftmanship of specialist precaster Concrete Bloc. The colour and bandwidths are uniform and crisp and the polished finish is of high quality. Concrete Bloc's expertise is further underlined by the fact that the plinths, in order to minimise costs, were manufactured as concrete boxes to be installed and in-filled with in-situ concrete on site. Each layered band width of each vertical side had to be synchronised.

At 40m x 20m, the plaza is not huge. Despite this it has a feeling of the monumental. It offers a peek at the geological history of the site. A journey to the centre of the Earth.

GRAND UNION

The CitySpace building at Sunderland centre is a vibrant campus hub, and a far cry from student unions of old

CitySpace is an unusual combination of social, sports and events facilities in a single flexible building. Designed by FaulknerBrowns Architects, the £11.5m building replaces the outdated student union building and provides the centrepiece of the masterplan for the university's city campus.

Upon entering the building, you find yourself in a triple-height space, which catches you unaware as externally the building looks relatively low. The extra height has been dug out from the ground. A second surprise is the mix of social and sports space. Rather than the bars and cheap beer usually associated with student unions, there is a climbing wall, six court sports hall, a 70-station fitness centre, as well as a cafe and dining areas. The University of Sunderland is obviously a place to improve both body and mind.

The eclectic mix of spaces is intended to ensure that the building is used every day throughout the year by the local community and not just during term time by the students (having a building that is deserted for many weeks does not make good economic sense).

Externally, the new building had to make its mark. The old student union that it replaced, Wearmouth Hall, had become a local landmark with its concrete tile decorative facade designed by the artist Mitzi Cunliffe, who also designed the Bafta mask. The new building provides a similarly strong presence thanks to its distinctive cut-out facade.

The main facade is made from crisp white precise concrete panels that are broken up with a random pattern of green glass rectilinear cut-outs. A mica aggregate makes the concrete sparkle against the five shades of green. In further contrast to the whiteness are areas of dark cladding, which help to break up the bulk of the building.

ABOVE
The distinctive facade combines white concrete with green glass cut-outs and areas of dark cladding

RIGHT
The cut-outs help to create a light-filled interior

The irregular pattern of the cut-outs is achieved using three main shapes of precast concrete panels: L-shapes, step-shapes and rectangles. Their repetitive nature reduced the necessary formwork, and therefore also the cost. The irregular layout of the panels called for close co-operation between the project team. The panels are supported and restrained by the structural frame using corbels for vertical loads and cast-in ties for horizontal loads. The use of threaded tie rods allowed close tolerances to be achieved. Incorporated within the panels is fabric and loose bar reinforcement that carried the loads back to the support point. Panel orientation and placement, meanwhile, was made easier through the use of multiple lifting eyes.

The green against white concrete is a bold treatment. And in keeping with ensuring that CitySpace earns its place in the community, the precast cladding not only looks good but provides thermal mass that contributes towards the building's BREEAM "excellent" rating.

PROJECT TEAM
Client University of Sunderland
Architect FaulknerBrowns Architects
Structural engineer Buro Happold
Contractor Morgan Sindall
Precast concrete Trent Concrete

Photos: Martine Hamilton Knight

A cafe is just one of the many facilities the building offers for both students and the local community

A LESSON IN ADDITION

Pie Architecture's task was to refurbish and extend a 1970s north London primary school in order to incorporate nursery pupils. The result is far greater than the sum of its parts ...

Completed last November, this project called for the relocation of a nursery school into the existing school building of St Joseph's Roman Catholic Primary School in Highgate, north London. In addition to a new entrance and classroom extensions, existing teaching spaces were reconfigured and refurbished in order to accommodate the nursery, and new external play areas were provided.

For the architect, north London-based Pie Architecture, the existing 1970s school building provided a strong reference point, with its concrete frame and vertical bush-hammered precast concrete cladding. Pie set out to introduce a new vocabulary that discreetly updated the old.

The two new extensions, in contrast to the temporary glass conservatory structures that they replaced, provide a robust solidity. They are built from double-skinned in-situ concrete – each skin poured at the same time, with rigid insulation sandwiched between. The walls are 400mm thick and have a precise, high-quality finish, the colour of which complements the existing building. The use of varying widths of douglas fir board has given the concrete a board-marked texture that echoes the verticality of the existing building.

Low boundaries provide a subtle separation between play areas

Internally, the concrete has a smooth matt finish, which reflects the light from the generous child-height windows and glazed roofs. Externally and internally, the concrete offers an understated strength, a monolithic presence that manages to be inviting. The attention to detail and scale means that the new extensions do not subtract from the original but instead give it a new lease of life.

The understated finish of the internal concrete complements the muted palette of the internal materials, which include birch plywood, sundela board, recycled yoghurt pot surfaces, reflective charcoal-coloured acrylic and thick woollen felt. The interior is quiet and restrained in contrast to the colour and creativity normally associated with primary-school learning and playing.

Outside, the douglas fir shuttering boards were re-used for the play pieces, planters and fences, adding to the sustainability of the project. The new play areas include low boundaries that provide a subtle separation between the younger and older children.

The programme and budget were tight – just nine weeks and about £240,000. Yet, despite this, Pie has managed not just to update the school, but to transform it both externally and internally.

BELOW
Douglas fir boards were used to give the concrete a marked texture

PROJECT TEAM

Client St Joseph's Roman Catholic Primary School
Architect Pie Architecture
Structural engineer HRW Engineers
Contractor JSP Building Services

Photos: David Grandorge

The colour of the concrete extensions (in the foreground) complements the existing school

Internally, the smooth matt finish of the concrete reflects the light from the generous windows and glazed roof

this is **low carbon**

Architect: Seymour-Smith Architects
Image courtesy of Dow Building Solutions and Sto Ltd;
Photographer: Samuel Ashfield

this is concrete

This is concrete

Underhill House, in the heart of the Cotswolds, is the first in England to be certified to Passivhaus standards. The home is built with concrete and masonry and is a stunning and comfortable home with exceptional thermal and airtight performance. **This is worth talking about.**

Want to know more? Join the discussion at thisisconcrete.co.uk

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