CONCRETE QUARTERLY

mpa The Concrete Centre

SPRING 2018 | ISSUE NUMBER 263

STEPPING OUT
AHMM gives a new look to London living, with board-marked interiors behind a brick-clad facade

RAW REVIVAL
Cartwright Pickard brings the industrial aesthetic back home to Manchester

MAKING FACES
How advances in precast concrete sparked the boom in brick-faced architecture

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AGENDA

Guy Thompson
Head of architecture, housing and sustainability, The Concrete Centre

Live well and prosper

Let's talk about health and safety. "Oh no," I can almost hear you groan. There surely cannot be many topics as unfashionable, unloved and maligned as this eminently well-meaning branch of building design has become.

The curious thing is just how enthusiastically everyone is embracing the related topic of health and wellness right now. Wellness started as a niche interest in the US but it has rapidly become a global movement, as corporates begin to catch on to the financial benefits of improving the health of their employees, and therefore increasing their productivity. Interest is growing in accreditations such as WELL and Fitwel, with BRE signing an agreement with the owner of WELL to pursue alignments with BREEAM. Building occupants, meanwhile, are themselves becoming more aware of how the places where they live and work affect them – notably, BRE's Housing Quality Mark is aimed at house buyers rather than builders.

The good news is that rather than an additional set of constraints, wellness in many ways takes design back to its fundamental purpose of creating pleasant, comfortable places to shelter. Many designers find themselves liberated and empowered to follow their natural instincts once more; others say it's what they've been trying to do all along.

Concrete offers a good solution to designers as it promotes high-quality internal environments through flexible, open layouts, into which daylight can permeate, with added benefits of passive ventilation and good acoustic separation. It does not give off volatile organic compounds or necessarily need to be covered up with paints that do. In this way, the trend for wellness dovetails nicely with the wave of exposed concrete surfaces now very popular among office developers and tenants – perfectly illustrated in this issue by AHMM's Weston Street and Cartwright Pickard's XYZ – and just coming into vogue in housing (Weston Street again).

Perhaps what the rapturous response to wellness illustrates is that many conventional approaches to "health and safety" have ignored the former to focus entirely on the latter. The wellness trend puts health – and how people actually experience buildings – back on the agenda. It may sound obvious, but buildings should be made for the people who occupy them, rather than those who design, sell or buy them – something that is often overlooked.

MANY DESIGNERS FIND THEMSELVES LIBERATED AND EMPOWERED TO FOLLOW THEIR NATURAL INSTINCTS ONCE MORE

this is concrete

WERE THE 80s REALLY SO BAD?

Postmodernism, it is generally assumed, is not a movement for concrete lovers, writes Nick Jones on the This is Concrete blog. But a new book by Geraint Franklin and Elain Harwood points out that modernists and postmodernists shared many of the same influences: "Once that's taken on board, you start to notice that concrete was everywhere in the 1980s, and that rule-bending postmodernism was using it in new and interesting ways," says Jones. "Franklin and Harwood make the case that the movement was not just a reaction to grey, concrete modernism, but a moment of 'pluralism' in architecture; less angry backlash, more loosening the corset strings."
www.concretecentre.com/news

CONCRETE QUARTERLY

On the cover:
87 Weston Street by AHMM
Photo: Timothy Soar
Produced by:
Wordmule
Designed by:
Nick Watts Design

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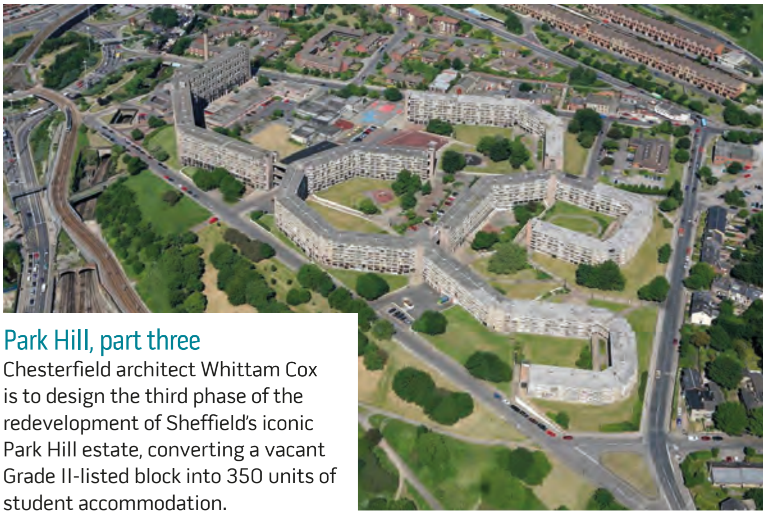
Kengo's cliff

Construction of the V&A Dundee is now complete, with opening set for September. Kengo Kuma & Associates' first UK building recreates a Scottish cliff face with curved concrete walls holding 2,500 4m-wide precast panels.

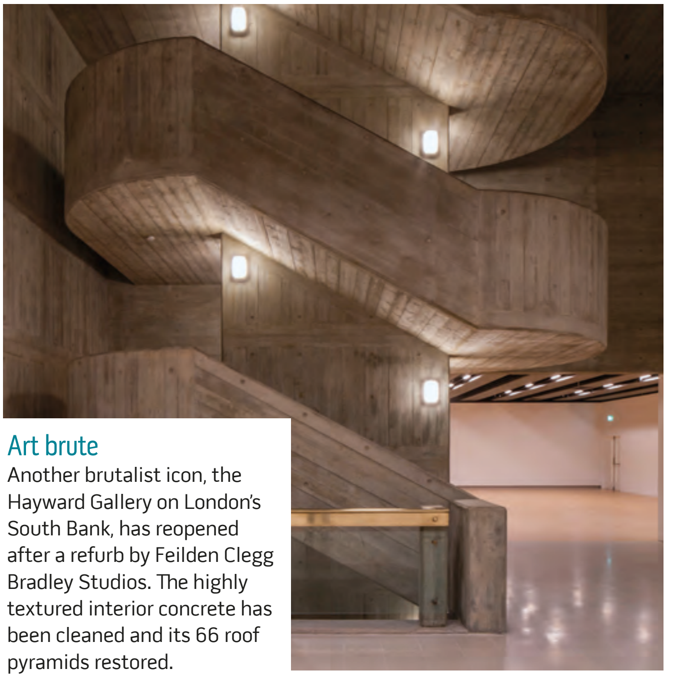
Roman roof

Foster + Partners' museum of antiquities in Narbonne, south of France, has topped out, its precast-concrete roof canopy inspired by Roman building techniques.



Park Hill, part three

Chesterfield architect Whittam Cox is to design the third phase of the redevelopment of Sheffield's iconic Park Hill estate, converting a vacant Grade II-listed block into 350 units of student accommodation.



Art brute

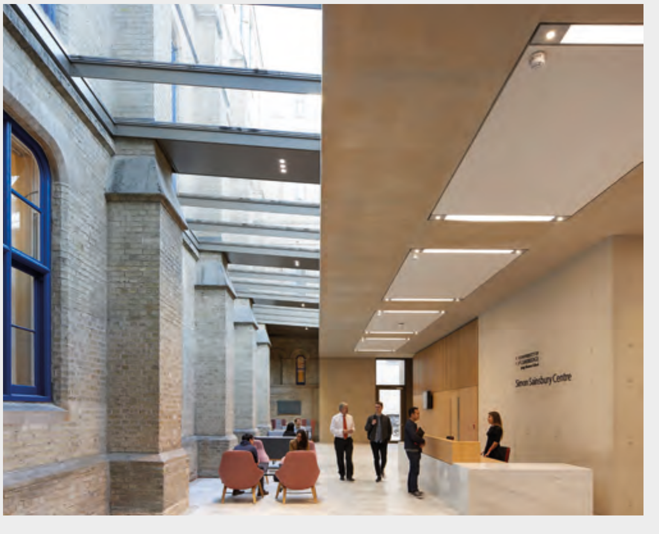
Another brutalist icon, the Hayward Gallery on London's South Bank, has reopened after a refurb by Feilden Clegg Bradley Studios. The highly textured interior concrete has been cleaned and its 66 roof pyramids restored.

Photos: Ross Fraser McLean; Nigel Young/Foster + Partners; Morley Von Sternberg; webbaviation.co.uk

LIVE AND LEARN

Spring's Concrete Elegance lecture focuses on Maccreanor Lavington's work at Garden Halls student residences in London (left and page 12) and Stanton Williams' Simon Sainsbury Centre in Cambridge (right). Both buildings benefit from an in-situ concrete frame and brick facade – but take the expression of concrete in different directions.

The lecture takes place from 6-8pm on 21 March at the Building Centre in London. To book a place, visit www.concretecentre.com



Photos: Tim Crocker; Hufton + Crow

INSIDE NUMBER 87

AHMM solves the puzzle of a complex gap site in London with a crafted block of interlocking concrete flats, writes Tony Whitehead

Photo: Rory Gardiner

Known unpretentiously as 87 Weston Street, this new mixed-use building in Southwark takes its place among some of the UK's most notable concrete architecture. The London borough is home, for example, to Charles Drake's ground-breaking concrete house, built in 1873, and the iconic National Theatre completed in 1976.

And now, just around the corner from the concrete tower of the world's tallest hospital, Guy's, is the latest addition to this eclectic gallery. Developed by Solidspace and designed by Allford Hall Monaghan Morris, number 87 is a residential and commercial project of just 31,000ft^2.

Small it may be, but for future generations there are features here that will surely epitomise the concrete of our time. It is a bespoke building. Each of its apartments is subtly different and the ground-floor office space is a one-off. All feature the carefully crafted, as-struck interior concrete currently enjoying such favour with the capital's designers and developers.

It is not, however, a concrete-frame building. Rather 87 is a concrete shell, and its load-bearing walls create a stepped series of eight interlocking apartments above the ground-floor office. The overall shape is reminiscent of the impossible 3D puzzles found in expensive toy shops.

"Because of the way the apartments interlock, and because we wanted to express that arrangement in the fenestration, a standard grid-based slab and column concrete frame was never going to work," explains AHMM's project architect Marion Clayfield. "So instead we have the in-situ reinforced-concrete shell, and although the exterior is clad in grey brickwork, we have expressed the concrete throughout the interior of the building."

Which meant of course that the choice of finish was everything – even more so than when visual concrete is used in a larger or purely commercial project. As Clayfield points out, the domestic scale is smaller, and the occupants are closer to the finish for longer periods of time.

A test process involved having three 2m x 1m concrete sample panels made up in the yard of the contractor, Oliver Connell. A retarder was used on two of these to expose some of the aggregate – achieving a light-etch and a medium-etch finish. A third panel was plank-marked and this proved the clear preference. (The architect and contractor both use the term 'plank-marked rather than 'board-marked' to emphasise the discernible joint pattern of the finish.) "It's more tactile, offering a warmth in the smaller domestic setting of the apartments especially," says Clayfield. "And the grain of the timber as expressed in the concrete helps to hide or tone down any inconsistencies [see "Dancing with concrete", overleaf]."

The concrete itself was a standard mix, though with 50% ground granulated blast-furnace slag (GGBS) cement replacement. "We included this both to reduce the cement, and therefore CO_2, involved in the construction of the building and

LEFT "Plank-marked" walls contrast with the smoother ceilings, which were cast using paper-faced ply board shuttering

Leader of the gap

Roger Zogolovitch had plenty of time to consider how best to develop the Weston Street site. His company, Solidspace, has owned it since 1985 and until recently was actually based there.

"We have thought seriously about development here – in conjunction with AHMM – for at least 10 years," says Zogolovitch. "That kind of timespan has given us a certainty about our ideas."

It is no surprise that the final design was based on a concrete structure. "Being in architecture for more than 50 years [Zogolovitch is the "Z" in celebrated practice CZWG], I've spent a lot of time thinking about materials and I have an urge to use them elegantly and simply. That's why I like concrete. There is no need to hide it. You have a structure, and it's apparent what the material is."

He has also found concrete well-suited to Solidspace's preferred type of development – the gap site. "These sites are a valuable resource," says Zogolovitch, "but they are often intricate and constrained. Some see that as difficult, but I see them as an opportunity for the architect's ingenuity to make a difference."

In this context, he adds, concrete's flexibility and ability to flow into almost any required shape can prove invaluable: "These are qualities you need when you carve out these spaces," says Zogolovitch. "Concrete is often the solution because it is admirably sculptural and in the depth of its section it is pretty much the same whether spanning horizontally or in a wall vertically. It also offers very good fire and sound protection without having to add to it. It is very simple."

Protection is a word Zogolovitch uses often: "We live in abrasive times," he says. "We are assaulted by traffic and noise and the pace of life. A home should offer protection – like a cocoon. And there is something wonderful about well-engineered windows fitting into a solid concrete wall that gives that sense of peace and solace."

Hence, the name Solidspace – less a brand than a philosophy for living.

also because of the colour. Adding GGBS makes it a little paler. We originally wanted a 70% GGBS mix but when we tried this out, in the unseen basement area of the building, we found that strike times, particularly in winter, were too long and would have proved costly in terms of the building programme."

Reverting to a 50% mix, explains Clayfield, reduced strike times from up to four days to 48 hours – but also kept the carbon footprint of the material within acceptable limits. This was vital as the building aspired to, and achieved, a BREEAM Excellent rating.

The building features photovoltaics and green roofs as part of its environmental credentials, but the thermal mass of the concrete is also key. Clayfield says that since the interior concrete walls and soffits have been left exposed, these remain in contact with the air and can thus readily absorb excess heat in summer, or during the day, and release it slowly overnight. This passive temperature modification results in cooler interior temperatures in summer and reduced heating costs in winter. A thick layer of insulation between the interior concrete walls and the exterior brickwork lowers the U-value of the external walls to a thrifty 0.15W/m^{2}K.

Entering the apartments, it is apparent that the interiors display the distinctive style that has come

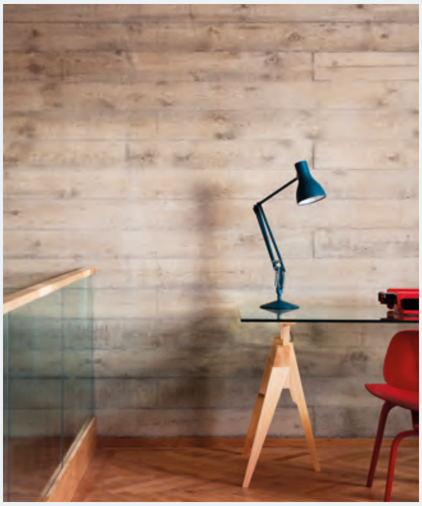
PLANK-MARKED TIMBER IS MORE TACTILE, OFFERING A WARMTH IN THE SMALLER DOMESTIC SETTING OF THE APARTMENTS

to characterise many of Solidspace's projects. Each apartment is split level, with different levels for working, sleeping and eating. The plank-marked concrete aesthetic is complemented by timber window frames and fittings in oak or walnut – the grain of the timber reflecting that expressed in the concrete. But while almost all the walls are plank-marked (there is hardly any plasterboard), the ceilings are smoother, having been formed from standard paper-faced ply boards.

"The exposed concrete meant we had to think about services very early in the design process," adds Clayfield. "For example while lighting in the kitchen is on a track, elsewhere we have cast-in conduits in the 200mm slabs. Obviously that means the lighting and electrics have to be designed and coordinated with the slab design before the concrete is poured."

Projecting out from the building on two sides are six precast concrete balconies and these are unusually deep, thrusting out 2.8m and adding a playful touch to the building's puzzle-style exterior. The balconies are cast in one piece with a light etch. They cantilever out from the slabs via a thermal break connection, but each is also held in place by four substantial steel brackets. "Some of the balconies reach almost to the canopy of mature trees outside, and it is possible to turn around, look back and get a great view of the building."

Residents who do this might note other precast details. The deep window and door reveals have



OPPOSITE The brick-faced building has deep cantilevering precast-concrete balconies

ABOVE Exposed plank-marked concrete runs throughout the domestic spaces

ABOVE RIGHT The plank marks were staggered in thirds

BELOW The ground-floor office is illuminated by a trench-like slit at one end and a glazed circular hole in the ceiling

been finished in pale precast concrete, as have the building's entrance canopies, which feature number signage embossed in the concrete.

There is no precast inside the building however: even the stairs within the two cores have been formed from in-situ concrete. "These are quite difficult as the (potentially uneven) top of the concrete is the part that you see," says Clayfield.

"They also have cast-in space for steel nosings to the treads. The contractor trowel-finished them and did a very good job."

With its smooth soffits and plank-marked walls, the ground-floor office space has the same finishes as the flats. The main difference is that this is an open, single-level space with an extraordinarily high ceiling. A lack of interior walls to support the ceiling slab means that columns are required here, but these have been kept to a minimum (just four) by the deployment of two large concrete downstand beams. These add a dramatic sculptural quality while also spreading the loads above.

Roger Zogolovitch, founder of Solidspace, says: "The ambition here was to make a calm, peaceful and creative space, and to use volume is an important part of that environment. So we have a 4.5m ceiling height and almost 5,000ft^2."

Zogolovitch is a keen advocate of concrete's ability to protect building occupants from the stress of contemporary life (see "Leader of the gap", left), but in the office space it has also been used to create an imaginative lighting regime. For example, a recess cast in along the downstand beams enables lighting to be set within them. In addition, and since not all the office space is topped by the building above, a trench-like slit running along one side of the ceiling allows natural light to filter down. Similarly, at the western end, a large glazed circular hole in the ceiling permits views of the trees and skies above. These features were also cast in – the hole being formed using plywood scored on the back to enable it to be bent sufficiently.

"We have tried to use light in a cathedral-like way," says Zogolovitch. As the daylight slants through the high ceilings to illuminate the sculptural concrete walls, it is easy to see what he means.

PROJECT TEAM

Architect AHMM
Structural engineer Form Structural Design
Main contractor Bryen & Langley
Concrete frame contractor Oliver Connell & Son

Dancing with concrete

Oliver Connell & Son managing director James Connell has spent decades in the business, but even he admits that "concrete sometimes seems to have a mind of its own. There are so many factors that can affect how it comes out – you're never really sure until you strike it."

But the plank-marked finish which is the unifying theme of 87 Weston Street is neat and regular, the concrete is consistent and the grain of the planks distinct. So how did they do it? "We have done quite a few plank-marked jobs recently so we know the yards that can supply good-quality timber," says Connell,

After that, it is largely a matter of detail. For example, the 22mm x 150mm planks were all planed on the concrete side to prevent loose strands of timber getting stuck in the concrete. The planks were also staggered in thirds to avoid vertical lines, and this meant that because of the intricate nature of the job, each piece of formwork was bespoke, taking up to one-and-a-half days to make.

"We couldn't reuse the formwork, but we did reuse the planks," says Connell. Having carefully dismantled the used formwork, the planks were brushed and jet-washed before being reused up to three times.

The highest walls, in the double-height sections of the apartments, were up to 7m and done in two pours. In order to neaten the horizontal line between the two, concrete was first poured to halfway up the top plank of the first formwork. This last plank was left in place and effectively incorporated into the formwork for the upper pour.

The efforts of Connell's team did not go unappreciated by his client. "How they operated was a pleasure to behold," says developer Roger Zogolovitch. "The way they coordinated and orchestrated everything – it was like watching a well-rehearsed dance troupe."

Photos: Tom Rothery, Rory Gardiner, Mike Abrahams

CLOCKWISE FROM ABOVE
Steel shuttering was used to achieve a continuous finish on the 500mm-diameter columns; The floor-to-floor heights are a generous 3.5m; Cycle storage has helped the building to achieve a BREEAM Excellent rating; The external precast-concrete cladding has a creamy, grit-blasted finish

THE XYZ FACTOR

Cartwright Pickard's raw aesthetic changes the rules for Manchester offices, writes Pamela Buxton

PROJECT TEAM
Architect Cartwright Pickard
Structural engineer RoC
Contractor McLaren Construction

XYZ is the first concrete-framed building to be completed in Manchester's Spinningfields by developer Allied London. Designed by Cartwright Pickard, the £30m building was intended to attract small and emerging TMT (technology, media, telecommunications) businesses as well as more established companies to the city's new business and leisure quarter. The strategy has been successful – a year before completion, XYZ's 22,600m^2 accommodation was fully let.

Concrete can take a fair share of the credit for creating a 10-storey building that is not only aesthetically distinctive but flexible, robust and at a cost of £122/ft^2 (for shell and core plus category A and B common areas), highly economical.

"We went with concrete because it had inherent qualities suitable for fire, acoustics and durability, and aesthetically we felt we could drive more value for the client. It's a very honest building," says Cartwright Pickard project director Robert Phillips.

Concrete is certainly everywhere in all its glory inside XYZ – as exposed soffits, walls, columns and as an eye-catching feature staircase. "This celebrates the way it's been constructed. All tenants have bought into the aesthetic," says Phillips.

According to the architect, the aim was to create a workplace with a quite different character to other office developments, not only at Spinningfields but in the city as a whole. The emphasis is on the creation of a shared community with multiple tenants sharing facilities such as a gym, coffee shop, bar/restaurant, cycle hub and concierge in additional to their own, customisable workspace. A particular feature of XYZ is its flexibility of servicing – tenants can choose to use either exposed fan-cool units, chilled beams, or a floor-fed system enabled by a 450mm floor zone.

A variety of construction techniques were used to realise the concrete frame and the industrial interior aesthetic. The central feature core was built as a jump-form core with traditional shuttering while the two end escape cores were slip-formed. In-situ concrete was used for the post-tensioned upper-floor slabs with voids for stairs and mezzanines. This allowed large spans, minimised internal columns and maximised flexibility.

The structure is arranged on a standard 1.5m grid with external structural columns at 3m centres. The main internal structural columns are at 7.5m centres down the length of the building while down the width, the central columns are spaced 9m apart. Floor-to-floor heights are generous (typically 3,500mm). Transfer structures use upstand beams contained within the floor zone to maintain flush slab soffits.

Photos: Hundven-Clements_Photography

The design team worked closely with the post-tensioned slab contractor to ensure that tensioning points were not visible in any exposed slab edge or around key voids. Any joints in the formwork were aligned with glazing, balustrade modules and the structural grid. Similarly, throughout the central core formwork tie holes were coordinated to ensure a visually acceptable pattern.

Considerable attention was given to refining the concrete specification of the main frame, with the desired light appearance achieved through the use of a mix of 85% CEM 1(OPC) and 15% GGBS.

The architects worked with the main structural frame contractor to create a textured finish on key feature walls in reception, basement and first floor level. After experimenting with various timbers, the practice used lightly sanded Douglas fir shuttering to produce the distinctive timber-board markings. Elsewhere, film-faced plywood shuttering in standard 2.44m x 1.22m sizes was used. The concrete finish was left raw with the exception of a clear lacquer in the stair areas.

For the highly crafted sculptural staircase – one of the focal points of the building – the architects collaborated with the specialist subcontractor to produce precast flights of stairs. These were craned in to the in-situ concrete stair core, using concealed connectors to ensure a seamless connection between the two. The curving winding soffits were smoothed by hand in the factory before being delivered to site and installed. Architect and subcontractor also collaborated on cast-in nosings and fixing details for the metal balustrades. The designs for these were finalised with the help of scaled plaster models, mock-ups and factory visits in order to understand the complex geometries and interfaces involved.

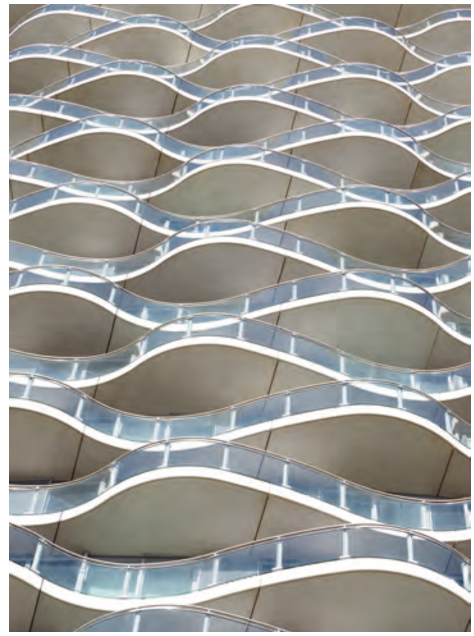
Reusable steel shuttering was used to achieve a continuous finish on the 500mm-diameter circular concrete columns. This avoided any horizontal joints over the full height of the columns, which rise 3.5m from floor to soffit on the office levels and 4.9m on the ground floor.

For the external concrete cladding, Cartwright Pickard worked with the architectural precast concrete supplier to create the vertical and horizontal components. These have a medium, grit-blasted finish to give a creamy overall appearance that will, the architect hopes, suit the Manchester climate and grow old gracefully.

As well as being key to the distinctive aesthetic of the building, the use of concrete contributed to the BREEAM Excellent rating through the provision of thermal mass, which has reduced the heating and cooling requirements.

Both inside and out, the use of concrete gives XYZ a distinct identity that sets it apart from many of its neighbours. "Previous new buildings in Spinningfields have typically been more glassy and polished, serving larger financial and legal corporations. XYZ was meant to be the antithesis," says Phillips. "It does stand out from the rest."

PREVIOUS NEW BUILDINGS IN SPINNINGFIELDS HAVE BEEN MORE GLASSY AND POLISHED. XYZ IS THE ANTITHESIS



HOOP DREAMS

CZWG has sculpted two towers of undulating concrete balconies in east London, writes Andy Pearson

Photos: Jack Hobhouse

Fluid, undulating rows of concrete balconies give the Hoola development its distinctive character. The balconies ripple around the floors of the two, virtually identical, 23 and 24-storey residential towers of the recently completed scheme, which is situated in London's docklands.

Concrete is integral to the two buildings. A concrete core forms the structural backbone of each tower, and this supports oval, in-situ concrete floor plates and the glazed facade at their perimeter, along with the distinctive precast concrete balconies. "These buildings are all about combining concrete with glass to create a great look," explains Rex Wilkinson, a partner at the project's architect, CZWG.

Wilkinson says the white concrete of the balconies had to be flawless. "If you're looking up at these buildings from below or simply looking upwards from one of the balconies then, boy, does your elevational material have to be immaculate, which meant using precast concrete," he explains.

To ensure the precast-concrete balconies were exact and free of blemishes CZWG worked hard to perfect their detailing. This included ensuring that the joints between the balcony sections lined up perfectly over the full height of the building. The practice was able to draw on experience gleaned 30 years ago on the landmark Cascades building (situated just a few miles further up the Thames), where it first conceived of using a thermal break with precast concrete balconies.

There is a lot of repetition in the precast elements: each balcony is symmetrical, the balconies on every other floor are identical and they are mirrored either side of the building."Varying and staggering the balcony widths ensure every apartment can enjoy a usable outdoor space that is not immediately overshadowed," explains Wilkinson.

The glass for the post-mounted balustrades was fitted by the supplier in Northern Ireland and is curved to precisely follow the balcony edge. "One of the nice effects of using curved glass is that it does not reflect light in the same way that flat glass does, so the balustrades appear transparent and, when the sun casts shadows of the balconies onto the facade, it has the delightful effect of making the facade itself appear rippled," says Wilkinson.

For the towers' residents, their beautifully crafted balconies offer views out over the Royal Docks, the Thames, the O2 arena, the Olympic Park and Canary Wharf with the skyline of the City of London as a backdrop. Residents will also be able to see the nearby ExCel Exhibition Centre, with which Hoola enjoys an innovative energy sharing agreement that allows it to use excess heat from ExCel's combined heat and power plant. This low-carbon heat source has ensured the £90m scheme generates 57% less carbon than is permitted under the 2010 Building Regulations.

CLOCKWISE FROM TOP LEFT
Varying the balcony widths ensures that none are overshadowed; The balconies repeat on every other floor; The 23 and 24-storey towers contain 360 apartments

PROJECT TEAM
Architect CZWG
Structural engineer Ramboll
Contractor Carillion
Precast concrete supplier Thorp Precast
Facade contractor McMullen

FISH 'N' CHIC

Ben Adams' hotel for sushi empire Nobu brings Japanese sophistication to Shoreditch, writes Debika Ray

CLOCKWISE FROM TOP LEFT
The facade combines glazing with 28mm-thick GRC panels; The interior aesthetic includes polished concrete floors and in-situ walls with expressed joints; A concrete DJ booth cantilevers over the bar

Photos: Nicholas Worley

Over the past 20 years, east London's Shoreditch has undergone a rapid transformation from gritty to desirable, via edgy, trendy and stylish. The arrival of the Nobu hotel – a name that would fit more naturally into a traditionally high-end district like Mayfair – leaves no doubt that the neighbourhood has now cemented its status as a playground for the global cultural elite.

The building's design, by Ben Adams Architects, reflects both the industrial heritage of its surroundings and the sophisticated aesthetic the Japanese brand is known for. Concrete proved to be the material that could tie these objectives together, as well as providing solutions to some of the brief's technical challenges. "It was one of those rare occasions when your aesthetic sensibilities and your practical concerns were both suggesting the same thing: build in concrete," Adams says, observing that the design achieved visual diversity despite the use of so much of the same material. "Taking concrete in several directions means it ends up being a completely different material in each case."

The practice inherited the project from Ron Arad Architects, which had secured planning permission in 2012 for a design that included the building's distinctive fragmented outline. When Adams took charge of the project in 2013, the firm pushed this fragmentation further – on the final building, overhanging floor slabs and cantilevered steel beams protrude horizontally from one side to dramatic effect. A pocket park is tucked under these projections, with a submerged courtyard that lets light down to the restaurant and bar below.

The specification of the concrete floor slabs arose from the restrictive nature of the site. "We were looking at how many rooms we could get into the building and, because of planning restrictions, it would have been difficult to make it any taller or wider. We realised that if we used post-tensioned slabs of concrete for the main structure, we could make it very thin and effectively get another floor of rooms in."

Concrete was also used in a technically sophisticated manner on the glass and concrete panels that form the facade. "The glass-reinforced concrete is only 28mm thick – the same kind of thickness as the glazing. That means you can use them in a similar way, which you wouldn't expect with a big heavy material like concrete and something thin and refined like glass."

The concrete theme continues inside, complemented by a palette of bamboo, timber, bronze glass and warm textiles. "We've got polished concrete on the floors and the lift shafts and staircases are formed of exposed concrete that again has its own aesthetic – circular depressions and the grid of expansion joints. It's just another way of using a similar material."

PROJECT TEAM
Architect Ben Adams Architects
Structural engineer Walsh Associates
Contractor MTD Contractors
Concrete contractor Leander Construction

FACING FACTS

Elaine Toogood explores the design and manufacturing process of brick-faced concrete cladding

You can be forgiven for not always recognising when a building is clad in concrete, especially when the panel incorporates a facing of brick. Brick-faced concrete panels can be a very effective means of combining the aesthetic of brick with the benefits of offsite manufacture. They are also a cost-effective way of achieving intricate brick detailing, which is otherwise challenging without the appropriate skills. As with any finishing technique for architectural precast concrete, it is worth getting a grasp of the manufacturing techniques at the outset to optimise the design.

The basics

Brick facing can be used for most bespoke precast-concrete applications, from arches and columns to wall panels, balconies, soffits and retaining walls. They can be used in combination with other precast-concrete finishes, within the same or adjacent units, and smaller elements can be used in combination with traditional brickwork, such as brick-faced lintels or underslung soffits.

The same design principles can be adopted as for architectural precast, with similar overall sizes, fixings and installation. The exact sizes, however, should correlate with the brick dimensions – just as with ordinary brickwork, small offcuts should be avoided. Detailing of reinforcement, thickness and specification of concrete will also typically be designed by the precast supplier to suit the structural requirements and other performance specification given by the design team.

As a guide, facade panels are typically around 200mm thick, incorporating 50mm facing brick (half-brick) and 150mm concrete. As with all precast cladding, insulation, windows and other facade features can be factory-fitted if required.

Brick selection

The selection of brick type is a key decision, not just for aesthetic impact but for manufacture and overall cost. Purpose-made precast brick slips or virtually any cut traditional brick material can be used, but not all brick types are appropriate or as easy to bond into concrete. A positive key at the back of the brick anchors it to the concrete. For brick slips, this profile of well-formed grooves is created when manufactured. For cut bricks the original perforations can provide the anchor once cut, otherwise a dovetailed slot can be cut in to the back. Pull-off tests will demonstrate if the key is sufficient.

Colour uniformity must be considered, and pallets should be mixed. It is common practice to mix pallets of bricks to avoid obvious variations on a facade, and this needs to be stated in the specification. This is particularly important for large expanses of brickwork, or where adjacent panels are manufactured at different times, increasing the risk of colour changes between panels.

At window reveals, corners, corbelling and other three-dimensional details, the bricks will require multiple finished faces and specials may be required. Significant cost and resource efficiencies can be made by using bricks with four usable faces, reducing the overall number of bricks required, with minimal wastage. Such bricks are often perceived as expensive, and while that may be true when set by hand, in precast cladding panels they are far more economically viable.

Ideally the brick manufacturer should be able to supply all of the bricks pre-cut, including any specials, within a specific delivery period to avoid delays in panel manufacture. Bricks that vary significantly in size are difficult to place and tighter manufacturing tolerances are required when casting in bricks compared to normal bricklaying.

SIGNIFICANT COST AND RESOURCE EFFICIENCY CAN BE MADE BY USING BRICKS WITH FOUR USABLE FACES

Manufacturing process

Bricks are placed facing-side down in the concrete mould, arranged in the required bonding or pattern. Proprietary templates are commonly used to hold the bricks in position, spaced apart by 10mm for the mortar joints. Non-standard patterns or brick sizes will require proprietary spacing templates. Three-dimensional elements may need an additional means of supporting the bricks until the concrete has cured. For complex shapes, this may require some ingenuity and it is worth discussing such details and their implications with a specialist supplier at the early stages of design.

Once the bricks are in place, the joints may need additional fill to prevent the concrete from seeping through to the face of the brickwork. This

▲ Garden Halls, London

TP Bennett's £140m Garden Halls student residence for the University of London in Bloomsbury shows how brick-faced concrete panels can be used to create a highly detailed, crafted facade.

The challenge that confronted the facade architect, Macreanor Lavington, was to develop a design that could grace a massive, contemporary nine-storey block of student rooms – a typology that is repetitive by nature – while also responding sensitively to its setting in a historic garden square opposite a crescent of listed four storey Georgian townhouses. Macreanor Lavington began to develop a highly articulated facade dominated by a sequence of stepped window reveals. The rationale behind

Photo: Tim Crocker

this motif was that by revealing the depth of the front elevation it would give the building an imposing stature while animating the façade with light and shade. Buff-coloured Petersen bricks were chosen for their association with domestic Georgian architecture, thereby creating a relationship with other buildings in the square.

It quickly became clear that the stepped soffits would be extremely difficult to make on-site, requiring a high level of craftsmanship and taking a great deal of time. Off-site manufacture, on the other hand, offered a degree of control over the complex brick detailing. The use of Petersen bricks offered a cost advantage here too: unlike most bricks, they have a good face on both sides, so both halves could be used to face the concrete panels.

The different precast elements of the facade were made by Thorp Precast in Staffordshire before being transported to the site. The building can be read as three distinct horizontal sections, and this is reflected in the process of precast manufacture. The ground and first floor form a base to the building, with each bay framed by a massive brick-faced precast-concrete pier. These piers, which are recessed every fifth course, were the first element to be craned into position; the brick-faced spandrels and concrete sills were then bolted on to either side.

Above this base level is the three-storey central portion of the building, which introduces the deep window reveals. These were manufactured as full-height T-sections, comprising brick-faced precast-concrete piers topped by the stepped soffit. Again, these were craned into position (see overleaf), with the spandrel panels and architectural precast-concrete sills slotted in afterwards. Finally, the upper section of the building is formed of two-storey T-sections, topped by a mansard roof. The roof was also factory-built, with glazed terracotta tiles cast onto the face of concrete panels.

Because of its depth, the cladding system can bear all of its weight back to the ground, with the building's reinforced-concrete frame only taking the horizontal loads from the facade. The piers and T-sections were simply stacked on top of each other and restrained back to the building's reinforced-concrete frame at the top of each section. This also meant that the designers could keep movement joints to a minimum, reinforcing the impression that this thoroughly modern facade is in fact a traditional monolithic brick structure.

ABOVE The intricate stepped soffits and window reveals designed by Macreanor Lavington for Garden Halls would have been extremely difficult to construct on-site

Photos: Thorp Precast; FP McCann

ABOVE The Lansdowne, a 16-storey apartment building in Birmingham designed by SRC and Building Design Group. The precast cladding panels, supplied by FP McCann, are 410mm thick and comprise an insulation layer between two concrete faces with an outer 80mm-thick facade consisting of a detailed buff brick design

LEFT A precast three-storey T-section, supplied by Thorp Precast, is craned into position at Garden Halls

is traditionally done with sand. The reinforcement and any lifting eyes and fixing supports are then put into position and the concrete placed into the mould, vibrated appropriately as it goes. When self-compacting concrete is used, vibration is not required. The exposed top of the concrete is usually a hidden surface so is simply levelled.

Once the concrete has reached its required strength, a day or so later, the formwork is struck and the panels turned over. The brickwork is then cleaned and, where required, mortar joints pointed before preparation for site delivery. Lifting eyes are typically located on hidden facings but one advantage of brick-faced concrete panels is that they can be placed on the surface if required to help with installation. The missing bricks are then fixed over the lifting positions once the panel is in place.

Mortar joints

Mortar joints may be pointed in the factory or on site depending on the project requirements and service offered by the precast manufacturer. Pointing on site can take place when the panels are in place, or on the ground before fitting, with obvious differing implications for installation and the need for scaffolding. The choice of mortar joint profiles will be determined by the same factors as traditional brickwork.

Brick slips offer the time-efficient option of pre-filling the mortar joints before the concrete is poured. The mortar is simply placed from behind, effectively cast in place rather than pointed. The profile of the mortar joint is created by the inverse profile of the brick spacers. Joint profiles available using this process create either a recessed or bucket-handle finish. Flush-filled and weather-struck mortar joints are not recommended using this technique.

Joints between panels

As with any visible precast component, the location and treatment of the joints is a key design decision and should be considered very early in the facade design, especially if there is the desire to minimise their visual appearance. Joint widths are typically larger than the 10mm mortar joints but may be comparable with the movement joints required of contemporary brickwork. They are determined by the tolerances necessary for manufacture, anticipated natural shrinkage and thermal expansion and the tolerance needed for installation. Panels should be designed to prevent them exceeding 20mm.

Early consultation with the precast supplier can help to reduce the size of joints. For example, tighter manufacturing tolerances are possible with smaller sizes of elements (see BS 8297:2017, Table 6) and installation tolerances are typically reduced where wall panels are self- stacking.

Joints are filled with sealant after installation and, to better coordinate and approve standards of quality, it is good practice to incorporate this into the precast manufacturer and installer's package of works. The sealant should be carefully specified to ensure the appropriate thermal expansion and to avoid colour-staining. A "dusted seal" is worth considering. This is where the joint is rubbed with mortar dust when newly applied, to take the shine off of the sealant and provide better visual consistency with the mortar joints.

Code of practice

Brick-faced precast concrete is included in BS 8297:2017 Design, manufacture and installation of architectural precast concrete — Code of practice, a new version of which was published at the end of 2017. This edition includes more detail on samples, testing and inspection procedures for brick-faced cladding than the previous version, and incorporates current methodology and practice.

There are no other significant changes that would affect architectural design decisions related to brick-faced panels. The standard states that typically "the first in line production panel forms the basis of an agreed quality sample", so designers should be clear if other arrangements are required. Viewing distances are stated as 5m for areas intended to be seen at close range and 10m for all other faces.

PUMP IT UP

There are many great examples of exposed in-situ finishes created using self-compacting concrete. Elaine Toogood explains how

To achieve a good standard of finish with exposed concrete, an appropriate mix is essential. This includes sufficient cementitious content (generally 350kg/m^3), the right balance and proportion of graded fine and course aggregates and importantly a low water-cement ratio (0.5 maximum). The mix is ideally pumpable, and so to achieve this without adding water, the concrete supplier adds a plasticising admixture. The resultant fluidity facilitates correct placement of the concrete, but careful and consistent compaction is still an essential part of the process to achieve a good standard of surface finish.

That is, unless self-compacting concrete (SCC) is used. SCC does exactly what its name suggests. The mix is supplied in a very fluid, almost liquid state, enabling it to flow unassisted into all areas of the mould.

Omitting the compaction stage has numerous advantages, including time and labour savings, but more specifically for visual concrete, less reliance on workmanship to achieve a good standard of surface finish. This is especially useful, and sometimes essential, when the formwork is congested with reinforcement and services, allowing little space for the vibration rod to be consistently effective. Potential damage to the formwork facing from the vibration rod is also avoided, giving more chance of reusing the facing, and avoiding marks on the concrete where the boards are damaged.

SCC is so fluid that it can also be pumped from low level up into the formwork – useful when access from above is limited. In such circumstances, the location of the pump needs to be carefully considered to reduce the visual impact of the 120mm or so round hole in the formwork where the supply is connected.

SCC for visual concrete is normally specified as a proprietary concrete – that is, a product developed by the concrete supplier for a specific application, such as 'exposed concrete walls' or 'exposed floors (self-levelling concrete)'. The mix is tailored to meet all the usual performance criteria stipulated by the design team in terms of strength, exposure and use of cementitious replacements, such as ground granulated blast-furnace slag or fly ash.

The fluidity is achieved using a combination of super-plasticiser admixture and carefully graded aggregates. The composition of the concrete is such that at the molecular level the particles repel each other, creating the fluidity without adversely affecting curing times or strength gain. The aggregate need not always be smaller, but this may be necessary for congested formwork. SCC can also be specified as a designed concrete, provided the engineer is sufficiently proficient in concrete technology, or has obtained the appropriate advice.

SCC may be a relatively recent development in concrete technology, but it has already opened up new possibilities in the detailed design and specification of visual concrete.

The Concrete Centre's YouTube channel has a short film in which structural engineer Will York of Price & Myers explains SCC. The video is an extract from a lecture about the award-winning Juergen Teller Studio: www.youtube.com/c/TheConcreteCentrevideos

SCC on the farm

Combe Manor Farm is an extraordinary house, nestled into the landscape of the Sussex/Kent border. Its recent completion follows a decade of careful construction and attention to detail by its Danish designer, contractor, client and now occupant. Sustainability was high on the list of considerations for both material selection and performance. The house is designed to Passivhaus principles, with high levels of thermal insulation and airtightness and very low energy use, assisted by the thermal mass of the exposed concrete structure. The concrete itself is pigmented, waterproofed and self-compacting, an innovative combination of concrete technologies. SCC was chosen to overcome areas of construction where vibration would have been challenging, and to achieve a high quality of finish.

Bodin and Nielsen was the designer and contractor and Price & Myers the structural engineer.

Photos: Bodin and Nielsen

SPECIFYING SUSTAINABLE CONCRETE

Jenny Burridge provides a recap on minimising the environmental impact of concrete, focusing on the use of cement for current and future practice

We last looked at specifying sustainable concrete in Summer 2014 (CQ 248). Since then, further research has been carried out into new and novel cements and how these can be used in the UK. This article covers some of this new work, while also providing a refresher into the guidance for specifying cements in sustainable concrete now.

CURRENT PRACTICE

Specification methods

There are five methods for specifying concretes in BS 8500, their use dependent on the type of concrete product being used and its required performance (see figure 1 below).

Concrete that is to be exposed to rain, frost or chemicals will require a different specification to concrete in an internal dry environment, with a corresponding different range of allowable cement types and content. A mix that will endure for 100 years inside a building may not last as long in the sea, for example. Stronger concretes tend to be more durable, but are also higher in cementitious content, so it is worth thinking about the location and specifying accordingly.

BS 8500 gives six exposure classes for different types of environment. These are shown in figure 2. The durability required for each class is given as a function of concrete strengths and cover to the reinforcement. The stronger concretes tend to be more impermeable and therefore less vulnerable to penetration by water, chemicals, carbon dioxide (which leads to carbonation – see CQ 259, Spring 2017) or chlorides.

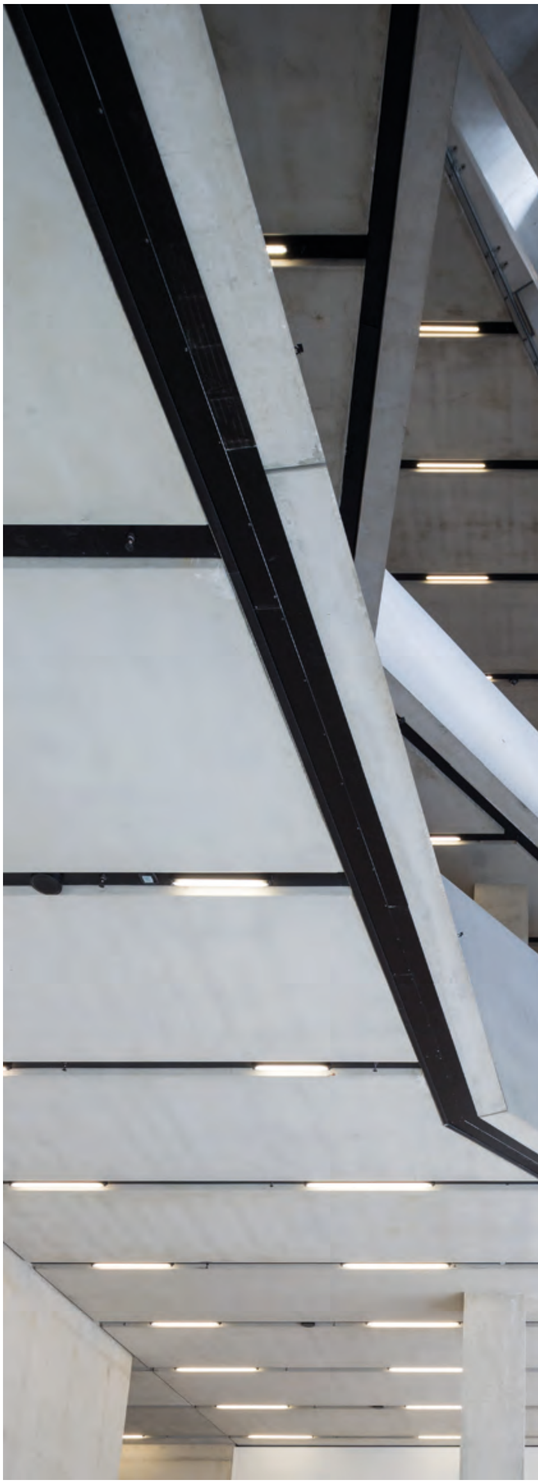
Reinforcement should be protected from chlorides to avoid corrosion. If chlorides are present, the tables covering XD or XS exposure classes should be followed.

Protection from carbonation and chlorides is not an issue for mass concrete, as this is unreinforced. Freeze-thaw and aggressive ground affect the concrete matrix and therefore affect both reinforced and mass concrete.

The Concrete Centre's publication, "How to Design Concrete Structures Using Eurocode 2: BS 8500 for Building Structures", provides a summary of the tables in BS 8500, giving concrete strengths, covers and allowable cement types.

FIGURE 1: SPECIFICATION METHODS

Specification method	When should it be used?	Key considerations
Designated concrete	Mass or reinforced concrete where strength is important and there are no chlorides present. Foundations where there are no chlorides present.	Cannot be used if chlorides are present. This method allows the concrete producer flexibility to select the most appropriate materials to give the required performance.
Designed concrete	Reinforced concretes, particularly where there are chlorides present. Visual (fair-faced) concrete. Where lower-carbon concretes are particularly important.	This method allows the specifier to define the concrete required. The concrete producer has some flexibility in the mix design to ensure that the performance requirements are met.
Standardised prescribed concretes	Site batching where ready-mixed concrete cannot be used. (At maximum cement content, the highest strength class that may be assumed for structural design is C20/25.)	The strength of the concrete cannot be specified and the cement content tends to be significantly higher than that for a designed or designated concrete. Do not use this method if a lower-carbon concrete is required.
Prescribed concrete	Specialised concretes where the specifier takes full responsibility for the performance of the concrete.	The strength of the concrete cannot be specified. Suitable if a concrete technologist is specifying the concrete. There is no flexibility for the producer to account for any inherent variation in the materials used in the concrete.
Proprietary concrete	Can be used for a number of high-performance concretes such as self-compacting concretes, low-shrinkage concretes, coloured concretes or high-strength concretes.	The concrete composition is designed by the concrete producer to provide a certain performance. The composition of proprietary concretes is confidential to the producer.



Cements

The embodied CO_2 of concrete is highly dependent on the amount of Portland cement it contains. But what we refer to as cement is not only made of Portland cement (CEM I) – it can also include other cementitious materials such as fly ash and ground granulated blast-furnace slag (GGBS). These additions provide some useful benefits, such as durability, workability and lower heats of

ABOVE The Switch House at Tate Modern, London, where a pale concrete containing 50% GGBS was specified

Photo: Iwan Baan

hydration. They are also products recovered from other industries, and are therefore low in eCO_2, and their use can reduce waste to landfill. Most modern ready-mixed concretes in the UK include such material. In 2015 there was a 28% reduction in embodied CO_2 from the 1990 baseline figure, due in part to the use of alternative cements as well as energy savings made in the production of cement.

FIGURE 2: EXPOSURE CLASSES

Exposure class	Form of attack	Subclass	Example of location type
X0	No risk of corrosion or attack		Mass concrete not exposed to freezing or sulphates in the ground
XC	Carbonation	XC1	Internal
		XC2	Wet
		XC3	Damp, or cyclic wet/dry
XS	Chlorides in sea water	XS1	External concrete near the sea
		XS2	In the sea
		XS3	In the tidal zone
XD	Chlorides not from sea water	XD1	Possible spray from de-icing salts
		XD2	Permanently in salt water
		XD3	Areas where de-icing salts are used such as car park slabs
XF	Freeze-thaw	XF1	External vertical surfaces without de-icing salts
		XF2	External vertical surfaces with de-icing salts
		XF3	External horizontal surfaces without de-icing salts
		XF4	External horizontal surfaces with de-icing salts
ACEC	Aggressive ground conditions	AC-1s to AC-5m	Foundations in non-aggressive (AC-1s) to very aggressive (AC-5m) soils

Concretes that contain high levels of fly ash or GGBS have longer setting times than pure CEM I concretes, but up to 35% replacement has little effect on the setting times. In cold weather the strength gain of concrete is reduced and therefore the percentage of additions that will allow a striking time of about three days is reduced. However, it is still possible to use higher percentages of cement replacement if admixtures are used that speed up strength gain.

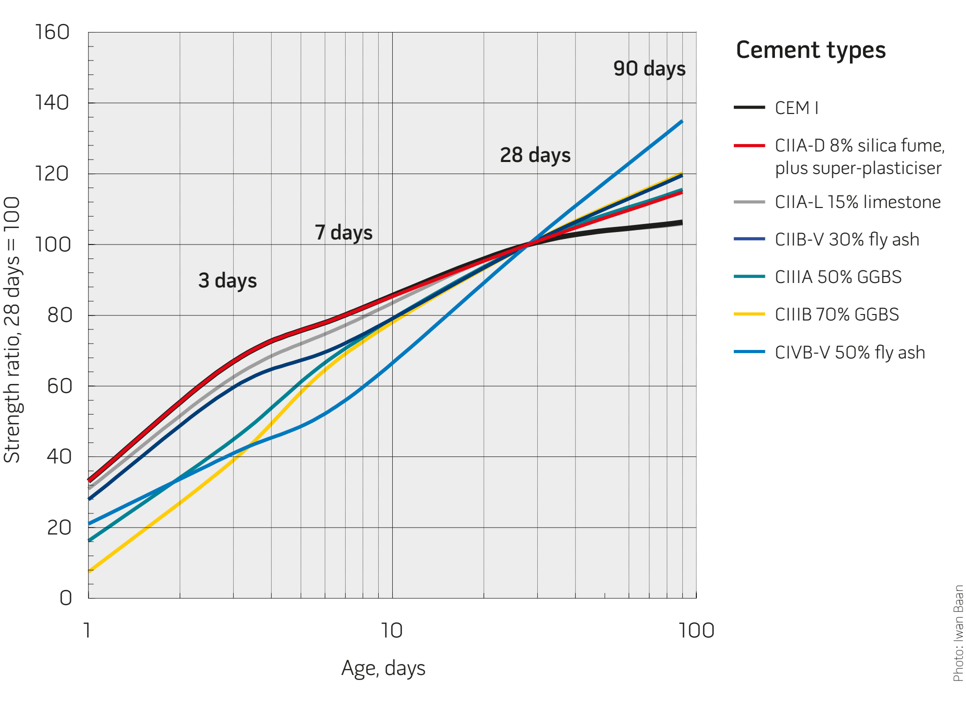
Figure 3 shows the relative strength gain of concretes with different proportions and types of cementitious material. The graph shows the effect of cement replacements on early strength and shows that all concretes reach the required strength at 28 days.

Cement types tend to be blended at the concrete batching plant and normally use fly ash or GGBS, not both. Fly ash tends to make the concrete darker in colour and improves its workability; GGBS tends to lighten the colour and improve its reflectance.

Responsible sourcing

The relevant standard for the responsible sourcing of construction materials is BES 6001,

FIGURE 3: THE EARLY AGE STRENGTH GAIN OF DIFFERENT CONCRETE MIXES



which can apply to all building materials and covers a range of environmental and social factors. The concrete industry adopted independent certification to BES 6001 from its launch in 2008. The latest published data shows that 90% of concrete produced in the UK is certified to BES 6001.

FUTURE PRACTICE

Multi-component cements

Finely ground limestone is a highly sustainable material with a wide array of uses. Due to its abundance and ease of processing, it has gained popularity as a filler material.

Limestone powder is already used in combination with Portland cement clinker to make cement – known as Portland limestone cement (PLC) – which usually contains about 15% limestone powder. In the UK, PLC is designed to meet performance criteria for most building applications and is permitted by application standards. While PLC is available in bulk, most is currently supplied in bags.

Recent research has demonstrated that if the grinding of limestone is optimised, PLCs can be produced to have similar performance to that of Portland cement CEM I, leading to significant cost and carbon savings without compromising concrete performance.

In the UK, fly ash and GGBS have been more popular than finely ground limestone, as higher levels of clinker substitution can be achieved. Possible solutions for optimising the use of limestone powder in the production of cement include either manufacturing higher-strength PLC or incorporating limestone powder in three-component CEM I-fly ash-limestone or CEM I-GGBS-limestone composite cements. Such practices are now commonplace in many European countries, and such cements are covered by the European cement standard EN 197-1. However, the use of three-component, limestone-containing cements is currently not recognised by UK application standards.

An amendment to the UK concrete standard has been proposed by MPA Cement and it is expected that three-components cements will be permitted via an update to the standard during 2018. This will enable specifiers to choose from a wider range of low carbon cements, while improving resource efficiency.

Photo: Roman Keller

ABOVE Christ & Gantenbein's extension to the Swiss National Museum in Zurich. The external concrete contains a proportion of fly ash as a cement replacement, which darkened the tone and reduced the water content

Novel cements

There is continual research into new and novel cements. The aim of these new products is often to reduce the carbon impact of calcination – the process, achieved by heating the raw materials to high temperatures, that is responsible for up to 60% of the CO_2 emitted from Portland cement production.

Most novel cements are hydraulic – that is, they react in a familiar way with water – but some are non-hydraulic, usually consuming CO_2 to solidify and harden. The quantity of limestone being calcined is usually reduced and, in some cases, eliminated.

Cements can be made to react with CO_2 if the proportion of limestone is reduced and kiln temperatures are lowered from 1,450°C to about 1,200°C. In this way, unique "calcium metasilicate" compounds are formed that react with CO_2 to form a hardened paste based on calcium carbonate and silica gel.

Researchers at Solidia Technologies claim that the manufacture of metasilicates produces 30% less CO_2 than Portland cement CEM I, with a potential reduction of a further 40% if CO_2 is fully sequestered. Hardening is based only on carbonation, and water is used merely to mix the material and is removed later in the process.

Due to the requirement of a CO_2 chamber, the technology is limited to precast applications. This product is also less alkaline than Portland cement, so it will require further investigation before it can be used with steel reinforcement.

New hydraulic cements are being developed. One is calcium hydrosilicate cement, which was invented in the 1990s at the Karlsruhe Institute for Technology in Germany. Limestone is again reduced and is heated at about 1,000°C to produce lime. This is then mixed with water and processed with silica under hydrothermal conditions to form partially hydrated calcium silicates.

It is claimed that this saves 50% of CO_2 compared with CEM I. When fully hydrated, calcium hydrosilicate cement has a chemistry not dissimilar to Portland cement.

If limestone is partially replaced with sulfur and aluminium bearing minerals and fired at a lower temperature of around 1,200-1,300°C, various calcium sulfoaluminate compounds are formed. The Aether project, funded by LafargeHolcim, is well established and full-scale industrial trials recently found that sulfoaluminate cements can be manufactured using identical kilns to those used for Portland cement, with an estimated 25% reduction in CO_2 emissions.

Some hydraulic cements can be produced without cement kilns. For example, by-product materials such as fly ash and GGBS can be activated using alkali chemicals (instead of CEM I). It is claimed that this process cuts CO_2 emissions by as much as 80% compared with pure Portland cement. PAS 8820 "Alkali Activate Cementitious materials" specification was published by BSI in 2016, which means that these can be specified for some applications, such as groundbearing slabs, with client approval.

However, as some activation chemicals are synthesised using an energy-intensive process, it is important to consider the additional embodied carbon.

Summary

- Specifiers can currently specify low embodied-carbon concretes and there are new developments that may further lower the embodied CO_2.
- Multi-component cements are widely used in other parts of Europe and will be included in the UK concrete standard in the near future.
- Novel cements will need to be tested for all the properties we rely on for concretes (particularly reinforced concrete), such as durability, bond and shear strength – but they offer the potential to dramatically reduce CO_2 emissions still further.

LASTING IMPRESSION
ALEXANDER SCHWARZ

COMPLETELY RATIONAL, COMPLETELY MYSTERIOUS

Normally if you're asked a question about your favourites, it's difficult to answer. But with buildings, there is an easy one: the Pantheon in Rome ❶ (c.120AD). I find it fascinating, that perfect dome. On the one hand, it's completely rational, and on the other hand, it's very atmospheric. Maybe the most interesting moment is the hole in the centre, where it is completely open.

I just visited the Oscar Niemeyer buildings in Brasília, and the Itamaraty Palace ❷ (1970) is one of the most striking pieces of architecture that I've seen. Again, on the one hand it's very rational and on the other completely atmospheric and mysterious. There's a prejudice that concrete is cold and has no atmosphere, but in those buildings the intensity comes from the structural possibilities of concrete. That large span, 30m without columns, is only possible because of the concrete structure.

Modern brutalist buildings need to be different to their surroundings – they need something to be modern against. In Brasília, it's the tropical nature against the concrete that is just incredible. Or it could be the traditional city fabric – we built our office in Berlin ❸ (2013) as four simple concrete volumes on a gap site from the Second World War. This narrative is very enjoyable but absolutely dependent on its setting of brick buildings and rendered buildings.

Le Corbusier's buildings in Chandigarh ❹ (1950-60) are completely fantastic. That's how poured concrete should be. I find it intriguing to see how these modern ideals were fulfilled against this striking nature. There is a very easy relationship between outside and inside that's more difficult to achieve in northern European countries.

Somehow in-situ concrete is one of the last remaining romantic materials. It's an opportunity to create an architecture that talks about building and not something else. We are always captivated by architecture that doesn't mean anything beyond what it is.

Alexander Schwarz is partner and design director at David Chipperfield Architects Berlin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Photos: 1. Fotolia; 2. AC Moraes/CC BY 2.0; 3. Ute Zscharnt; 4. VIEW Architecture

FROM THE ARCHIVE: SUMMER 1960

SERENITY IN THE CITY

In 1960, CQ got the chance to visit Brazil and witness one of the most ambitious architectural projects of all time. In 1955, the new president Juscelino Kubitschek had decided to build an entirely new capital city from scratch. Brasília was "the product of two brains only," wrote CQ: "the plan, Lucio Costa's, the buildings, Oscar Niemeyer's". In just five years, it had become a reality – albeit with plenty of work still to do: the city was, CQ noted, "a place of widely scattered buildings, red earth with runnels of water shining in the sun, red mud sparkling".

Already risen from the red earth, however, was one of Niemeyer's great showpieces: the Presidential Palace. It is striking how different the language CQ used to describe this building was to the other great buildings of the 1960s. The façade was "serene"; the columns "swans", their slender neck-like stems rising from a smooth mirrored pool and "festooned along the veranda". The sinuous concrete curves of the terrace were "wonderfully unthickened" by their white marble cladding.

Access the full CQ archive at www.concretecentre.com. The book, *The World Recast: 70 Buildings from 70 Years of Concrete Quarterly*, is out now, available from www.concretecentre.com/publications

FINAL FRAME: HOLOCAUST MEMORIAL, OTTAWA

Daniel Libeskind's Canadian National Holocaust Memorial is formed from tall, angular in-situ concrete walls laid out in the points of a star. The concrete creates a sombre backdrop to a series of enclosed spaces and is painted with detailed, large-scale versions of Edward Burtynsky's photographs of Holocaust sites. In the central space, a "Stair of Hope" cuts through a dramatically inclined wall.

Photo: doublespace photography