BUILDING ENVELOPE

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Building Envelope Supplement

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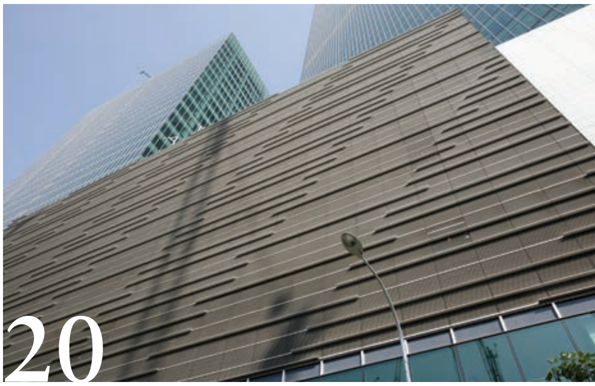

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FROM THE EDITOR

Welcome to your special *ADF* supplement focusing on all things building envelope, from the practical challenges to the aesthetic benefits of innovative product solutions, to the truly ingenious appliance of science.

Covering all three is our project report, which looks at architects AHR's design for the new northern home of the Royal College of Physicians in Liverpool. As might be expected, the client took a decidedly scientific, not to say anatomically-inspired, approach to briefing the architects, and wanted to see evidence-based decisions throughout the job.

The result is a patterned glass facade which provides a distinctive look, inspired by human skin, but which also shades the interior, thanks to millions of ceramic polygons printed onto the glazing. The building is targeting WELL Platinum, meaning it offers the highest standards of physical wellness to its occupants, assisted by a cool, airy environment. The envelope is probably (at least in large-scale buildings) the biggest contributor – positively or negatively – to a building's performance, and this will be increasingly true as our climate warms.

Elsewhere in the supplement, we look at a more specialised area of performance, with two expert insights into envelopes and new regulations. There is an interesting take on the subject of whether new regulation is intrinsically a headache, or whether it is actually an essential driver of innovation, and one which is leading to a 'meritocracy' in building engineering.

Dr Jonathan Evans of cladding suppliers Ash & Lacy says he believes the latter, and that the Building Safety Act toughening the fire safety regime is a case in point. Rather than Dame Hackitt "demanding change," he says, legal requirements to avoid combustibles in cladding has focused the minds of companies on providing a better fire performance offer with alternatives. As part of the new focus on R&D, suppliers are providing credible evidence, he asserts.

In a more niche area still, the appropriately-named Graham Laws of Siderise explores the legal requirements for cavity barriers in ventilated facades, on fire safety grounds, while avoiding damp issues from the same barriers. We also have features from Construction Specialties, Knauf Insulation, Spanwall, and the Brick Development Association.

We hope you enjoy this array of interesting content on building envelope design!

ON THE COVER...
The Spine by AHR, located in a new 'health campus' in Liverpool, is the new WELL Platinum headquarters of the Royal College of Physicians, its performance assisted by an innovative glass facade
Cover image © Dan Hopkinson
For the full report on this project, go to page 12

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SUSTAINABILITY

UNStudio campus building harnesses facade for carbon-positivity

A university campus has been recently completed at TU Delft in the Netherlands to a design by UNStudio that provides the client flexible teaching space in an “energy-generating” building which is also designed to promote “physical, psychological and social health.”

UNStudio – in collaboration with Arup and BBN – addressed the challenge of ever-increasing student numbers by designing a campus to meet the Dutch university’s need for flexible extra teaching space – now and in the future.

Ben van Berkel, co-founder at UNStudio commented: “The Echo building teaches by example. In this highly compact building, the use of space is maximised, while bringing students from different disciplines in closer contact. Not only can they condense their learning experience and learn from each other, but they can also learn from the building itself.”

Claimed to be the most sustainable building at the TU Delft, Echo is intended to “harvest more energy than it uses” during operation, in turn contributing to the university’s ambitions to operate a fully sustainable campus by 2030.

1200 solar panels, smart installations, good insulation and a heat and cold storage system “ensure that Echo will be able to provide more energy than it requires for its daily operations,” said the architects. This includes user-related energy, such as electricity consumption for laptops, lighting and catering, and 90% of the furniture in the building has also been reused.

“Transparency was essential to the design of Echo.” It “ensures maximum daylight inside the building (known to have health benefits for the users, but also reducing the need for artificial lighting),” and creates a visual connection to the wider campus and to surrounding nature. As such, “a closed-in, ‘institutional’ experience for the users is avoided, while the “open and public” character of the building connects the two sides of the campus and provides a “bright, uplifting and welcoming environment for faculty and students alike.”

Overheating is prevented, said the architects, by a combination of sun shading and the “low solar penetration factor “of the glass, plus deep horizontal aluminium awnings which keep out excess solar heat. These canopies are interconnected by cables along which climbing plants form a “subtle green facade” that filters daylight.

To ensure clean air in the building, a plenum floor is installed above hollow-core slabs. Here, fresh air is pumped up from the floor, rather than down from above, thus avoiding circulation around the room. The vents for this system, along with the computer floor installation, can easily be relocated, should the layouts of the rooms change in the future.

Not only has a great deal of attention been paid to the environmental impact of the materials used in the construction, but the building has also been designed as much as possible according to principles of circularity. Using large portal constructions with large grid sizes, the columns run along the edge of the building, creating column-free spaces with large spans. The steel trusses have standard sizes and can be dismantled so that they can be reused elsewhere after the lifespan of the building. The hollow-core slabs can also be reused in the future.

COMMENT

In celebration of regulation

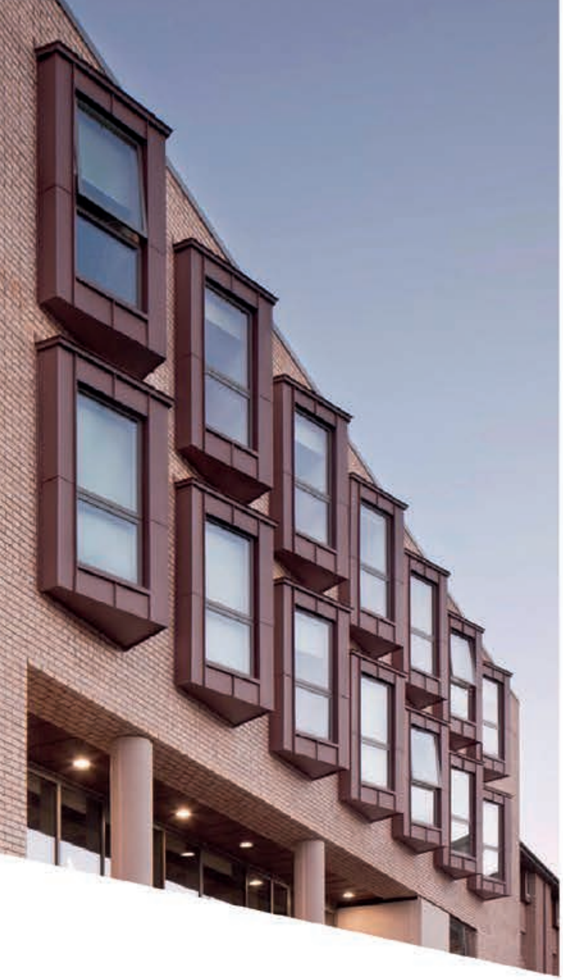
Dr Jonathan Evans from Ash & Lacy says that, far from stifling innovation in envelope design and cavity trays, the recent safety regulations actually put the UK on the verge of a 'meritocracy' that will benefit future buildings

Contained in June's Government response to the industry consultation on the ban on combustible materials over 11 metres, there's a really interesting comment. Namely: "We do not believe it is appropriate to permanently exempt cavity trays, as it would hinder innovation in development of additional compliant products." Hallelujah!

One of the arguments I have consistently tried to refute made by those opposing tighter regulations on fire safety is that regulations hinder innovation. Clearly, if you say 'it must be made of 1 mm thick steel,' then that's a prescriptive requirement which will inevitably limit choice and design freedom. But a combustible materials ban is a 'performance' requirement – you can do anything if it passes the relevant test.

Anybody who has the creativity to have invented anything (or even rarer, has gone on to commercialise it), will understand that if there's no demand for something, then it's unlikely that somebody

AN AIR OF PROGRESS
According to the author: "regulatory determination, despite industry whining, drove the invention of the catalytic converter and changed the world"




PERFORMANCE BASE
Thermal performance is set to become an even more critical factor in building design

The new Regulation 7 on external wall materials has stimulated the development of a large number of products

would be motivated to come up with a solution, never mind that people wouldn't buy it if you did. Engineering history is peppered with examples where regulatory change has driven innovation that wouldn't have happened otherwise. The story of the Clean Air Act and the catalytic converter is my favourite example of the good that can come from regulators who hold their nerve and demand progress. Human ingenuity will always prevail, especially when there's a financial reward.

The Government didn't want a ban on combustibles, but fire safety became a political issue and that trumped civil service reluctance. However, the new Regulation 7 on external wall materials and the underlying direction of regulatory travel has stimulated the development of a large number of products with improved fire performance and associated certification evidence.

Without question this is driving culture change too. Companies are realising that investing in research and development will generate a worthwhile return. This creates demand for more skilled engineers and researchers and this stimulates the need for companies to appear more attractive to incoming talent. The higher the bar, the bigger the reward for those forward-thinking companies who can attract innovative staff and develop new products that address regulatory progress.

The Dame Judith Hackitt model of demanding change from industry leaders is futile; there has to be a tangible benefit. In an industry where there are no regulations and little product differentiation, the lowest price will always win. Regulation 7 massively changed the way buildings over 18 metres are designed, specified and built. Fire is always the first topic of conversation in an enquiry.

As we adapt to the new fire regulations, coming up close behind is a new thermal performance threshold which is starting to drive innovation in building systems. The Future Homes Standard will reward companies who deliver innovative new products to realise better performance at lower cost.

Regardless of the disputed relative merits of using various construction materials, one thing that cannot be disputed is that the less material you do decide to use, the better. We have developed a pioneering, 'generative-designed' cladding mounting system using a software tool; the result minimises the use of aluminium or steel in a polymer-free solution designed for ultra-high thermal resistance.

Insulation thicknesses are increasing, so brackets are getting longer and thermal bridging is becoming more important; this rewards innovative, high-efficiency designs. Continued development in this area coupled to an increasingly digitised design and manufacture process will be the defining theme of our business development for the coming years.

It's not just regulatory necessity that drives change. We're hurtling towards a skills shortage that will inevitably drive demand for more value to be added at the production stage. Rather than fight it and demand freedom to continue to use low-cost labour that drags down wage levels, this should be the watershed moment for MMC (Modern Methods of Construction). I gave a talk over 20 years ago following the Egan Report and said that nothing would change without regulatory pressure or cost advantage.

It's not enough to be better, for something to take off it has to be 'cheaper' too – however you choose to interpret that. I got booed, but I still believe this to be the case, and if you don't believe me, read about the pathological behaviour of corporations since the late 17th century. All industries have the capacity and fair share of individuals who will exploit and expose poor regulation – Dieselgate, Boeing 737-MAX etc. My hope is that regulators hold their nerve and treat with extreme suspicion those who say 'it can't be done.' Set high standards and those who have high standards will come forward to meet them.

I will be hosting a webinar on 8 September exploring this topic in more detail, and I welcome fellow industry professionals to join what will undoubtedly be an important conversation for all of us. To register interest, email Aneira.beament@ashandlacy.com for further information.

Dr Jonathan Evans is CEO at Ash & Lacy

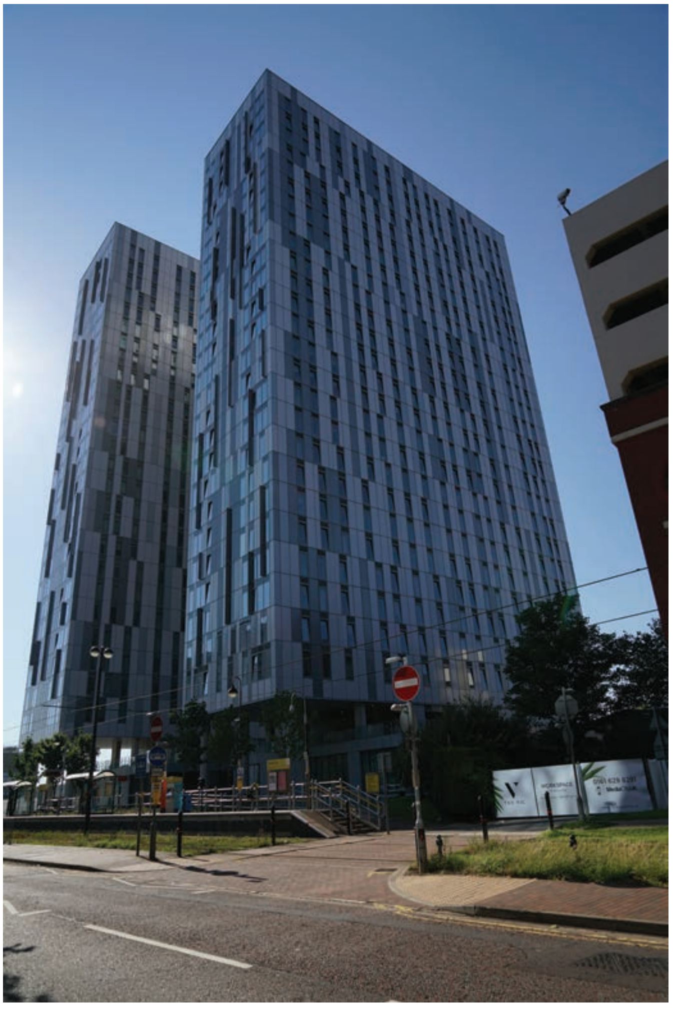
COMMENT

Creative cavities

The requirement for an open cavity in ventilated facade systems can present a challenge when it comes to ensuring the passive fire safety of the building envelope. Graham Laws from Siderise Insulation looks at the issues, and suggests solutions

Also referred to as 'rainscreen' systems, ventilated facades are designed to protect a structure, allowing any moisture that penetrates the external facade to drain away through the gap left between the exterior and the insulation layer. In addition to preventing issues with damp or mould, the air flow within the cavity allows the whole system to stay cool in summer, warm in winter, and provides some acoustic benefits. Combine this with the huge amount of design freedom they offer, it is easy to see why these systems are a popular specification for new build and refurbishment projects of all sizes.

However, this open cavity can present a fire risk if not carefully considered. If a fire entered the wall construction, this void would act like a chimney, drawing the flames, smoke and heat up the building and causing the fire to spread to multiple floors, with obvious potentially negative consequences. To prevent this happening, there is a legal requirement for the cavity to be closed



off using cavity barriers – blocks of fire-resistant material which seal the cavity to create compartments and prevent fire spread. However, this is an approach which could conflict with the daily requirement for the cavity to be open to allow ventilation.

Addressing the conflict

Typically made from non-combustible (A1-rated to EN 13501-1) insulation covered with reinforced and waterproof aluminium foil faces, standard cavity barriers are 'full-fill,' meaning they completely seal the cavity. They are ideal for vertical applications in ventilated facades as they help to maintain the air pressure within compartments, preventing the fire from spreading horizontally around the building. However, in a horizontal application, they would prevent the system from effectively ventilating or draining away rainwater, leading to issues of damp within the building envelope.

Open-state cavity barriers were developed as a solution. These include an integral intumescent material that rapidly expands in reaction to high heat (around 130°C). This allows them to be fixed to the internal cavity wall, leaving the ventilation gap open to allow for free vertical movement of air and drainage day-to-day (sometimes referred to as the 'cold state'). However, in the event of a fire, the intumescent 'exfoliates' in a matter of seconds until the void is fully closed and a robust fire seal is formed.

There is understandably some difficulty using the standardised tests to determine the performance of open state cavity barriers, as the time taken for the gap to close would initially lead to a 'fail'

Tested performance

With such a crucial role to play in fire safety, it is vital that cavity barriers are carefully tested to ensure they meet the performance dictated by local regulation.

It is also increasingly common for specifications to go beyond the regulatory requirements, asking for 30 minutes performance for both integrity and insulation. This can be driven by several factors, from insurance or warranty requirements to project-specific requirements, or misunderstandings about what performance is required. It is also important to note that cavity barriers can only be used in conjunction with insulation whose fire performance is equivalent to or better than the type they have been tested with.

These results are gained through specific small-scale tests that examine the product's independent performance and relevant criteria, unaffected by other system components. Standard full fill cavity barriers can be tested to EN 1366-4 fire resistance tests for service installations – Part 4: Linear joint seals. This standard determines the fire resistance of linear joint seals based on their intended end use. It tests horizontal and vertical applications and allows some movement in one direction before the test starts.

However, there is understandably some difficulty using the standardised tests to determine the performance of open state cavity barriers, as the time taken for the gap to close would initially lead to a technical 'fail' – even though as soon as the intumescent has activated, fire integrity and insulation is established. To help resolve this issue, the Association for Specialist Fire Protection (ASFP) produced a technical guidance document, TGD 19. This outlines the test configurations and failure criteria for testing of open-state cavity barriers and the pending prEN 1364-6 standard which is being developed specifically for cavity barriers. The test is based on the existing EN 1366-4 linear joint seal test (using the principles of EN 1363-1) but modified with upstands to better replicate the cavity construction and allows five minutes for the intumescent seal to close the gap.

Note that, even with the inclusion of cavity barriers, systems can fail if the external rainscreen facade allows the fire to spread up the outside of the building causing the cladding to move, break down or come away and leave a path for the flames to spread up and over the cavity barrier and up the cavity. Therefore, it is vital to always refer to the latest regulatory advice for facade design and specification, and to ensure high quality workmanship at every stage.

Breathe easy

Ventilated facade systems can bring a wealth of creative potential to a project. By using modern cavity barrier products that have been designed and tested for use within these systems, designers can ensure that their buildings reap the benefits of the daily airflow, while also protecting the building envelope when it matters most.

Graham Laws is technical director at Siderise Insulation

BUILDING PROJECTS

THE SPINE LIVERPOOL

Under the skin

The Royal College of Physicians' new teaching base in Liverpool has been designed with an appropriately scientific approach, resulting in one of the world's healthiest buildings, including a bespoke patterned envelope. James Parker reports

A medical education facility designed with an unusual amount of research behind it has emerged in Paddington Village, a new part of Liverpool designated as the 'Knowledge Quarter.' It was conceived when the city council and university came together to develop a vast heath campus, adjacent to the Royal Liverpool Hospital and Clatterbridge Cancer Centre, the latter formerly being located on a site in the Wirral.

The venerable Royal College of Physicians (RCP), established in 1518, approached Liverpool, Manchester and Leeds in 2016 as it was looking to expand its physician training centre out of London, after being based in the capital for 500 years. "They were perceived as being very London-centric," says Robert Hopkins, architect and director at AHR, but that the college "had changed a lot in that time," and wanted to be closer to its members across the country.

Despite an original assumption that the college might end up in Manchester, he says the offer from Liverpool "was so compelling," that they "sensed there was a real partnership there, and that they were going to part of the city's vision for health."

The mesh-like frit pattern creates a "forest canopy" effect internally, to benefit users and minimise cooling

Liverpool City Council, who developed the project, offered a deal to the college, namely that if they would take half of the 151,000 ft² building on a long lease, they would get to influence the design, and the choice of architect, via staging a competition.

Brief

Hopkins explains that the remit of the new £35m building was a essentially commercial one, and as a result the architects had to work to the usual constraints in terms of its viability such as establishing the net to gross floor area, working to BCO guidance. The architects had a "very loose" brief from the college, beyond wanting to expand out of London, and they spent around six months with the client exploring what they were already doing, and what they wanted to do.

"It became very clear they also wanted to do conferences and events, exhibitions, public outreach," says Hopkins. They also wanted the space to house the practical MRCP examination, alongside teaching and research, which the college hadn't been able to do on its Regents Park site.

One of the clear drivers was that the college "didn't want to replicate what they had in London." For example, they wanted a Harvard lecture theatre, which is based on a more 'open' format; illustrating how the college also wished to move away from its self-confessedly "insular" nature in its London incarnation. "They were really keen to be seen as an outward-facing organisation."

As part of this new approach, the client arrived at an aspiration to "set new standards in workplace and biophilic design," and a driving ethos that people 'will be healthier when you leave the building than when you walk in.' This momentum led to a target to achieve WELL Platinum, which will make it, once certified, one of the few buildings in the UK with this level of workplace sustainability certification.

The client wanted a very considered design as a recruitment tool for students and staff: "The brief was to attract and retain a highly-skilled workforce, supported by a unique layout and design which uses biophilic interventions throughout, with connections to nature being proven to reduce stress and increase productivity."

Hopkins says that they "didn't just want a certificate on the wall, they really meant it"; this included being very invested in the design process.

Design development

AHR's 2017 competition entry was about "looking at the values of the college; health outcomes," says Hopkins, and asking ourselves how we could turn that into architecture." The briefing process was unusual for AHR, with the client scrutinising the design at each stage, and asking the architects what research they were using to back up the decisions. This meant showing evidence-based research on "literally everything," says Hopkins, "down to door handle materials; it was a four-year research project."

One evidence-based scientific design accreditation approach, The WELL Standard, had emerged a couple of years earlier, in the US, "connecting all systems of the human body to their environment," says Hopkins, and the project team embraced it fully. He adds: "We thought it was a really great way to manifest the values of the college," and would also ultimately be the measure of how the building actually affected its users.

This was AHR's first WELL project, but Hopkins was happy to discover it was a highly useful system for steering the design with the full involvement of this particular client. "Each of the points within WELL has three or four research papers associated with it. I was focused on it from the design perspective, but the client team read the papers, and understood the reasoning behind it." Their interest was bolstered by the fact that many of the papers, although written in US academic institutions, were by fellows of the college, who also helped compile the standard itself.

The architects collaborated closely with the contractors to deliver some of the more uncompromising aspects of WELL in aspects like VOCs in products, as a result The Spine "doesn't have that new building smell." Air quality is a key aspect of WELL, and managing the CO_2 content of indoor air in particular; BCO and CIBSE recommend air quality levels of around 1200 ppm (parts per million).

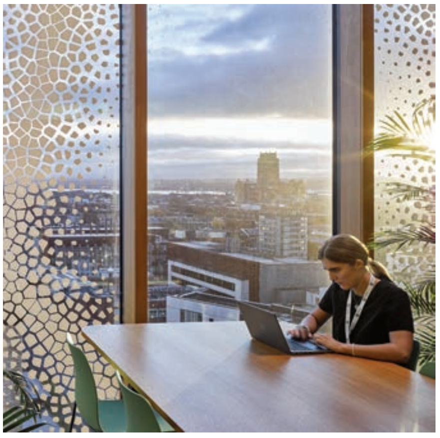
With cognitive function being impacted to a greater degree between 900-1200 ppm, the architects aimed for 800, but in use the building has stayed under 600. "The college loved things like that – actually making people more effective," says Hopkins.

He admits there was a perception in the project team that designing to WELL would mean a premium added to the final cost, but the architects insisted that it was already included during the specification. In the end it has only added 3% to the build, says Hopkins, including a vast array of planting across the interiors (whose specification was driven by 1989 NASA research which showed physiological benefits of plants). The shell and core came out at £1850 per square metre.

Engineering a WELL facade

As a design metaphor embodying the purpose of the building, a "narrative of the human body" has been expressed in several elements: planting – 'lungs,' helical stairs – 'vertebrae,' and patterned concrete columns representing the body's trabecular system. The most explicit example is the fully-glazed external facades, which are printed in a seemingly random, 'Voronoi' ceramic frit pattern. On closer inspection it is composed of clusters of polygons (23 million of them in fact, and each unique), inspired by the structure of human skin.

The mesh-like frit pattern creates a "forest canopy" effect internally, to benefit users and minimise cooling. This 'dermis'



The briefing process was unusual for AHR, with the client scrutinising the design at each stage, and asking the architects what research they were using to back up the decisions

layer is far from merely decorative. It has a crucial function in moderating internal temperatures, like human skin, there being no other shading present. The level of ceramic applied doesn't seem to vary greatly across the facades to the naked eye, but it's been painstakingly designed according to the sunlight levels on each. There's 15% coverage on the north facade, 25% on the east and west, and 35% on the south.

The competition-winning facade design was very different however, being based on "dancing DNA," says Hopkins. The architects were encouraged "very politely" by Jane Dacre, then president of the college, to change the approach to something more relevant to physicians, although still referencing the human body. The AHR architect who created the complex Voronoi pattern (using Grasshopper software) had originally studied mathematics, so "this was his moment," says Hopkins, following in the footsteps of the celebrated Russian mathematician Vorony.

The designers then presented 1500 different patterns to glazing manufacturer Saint-Gobain, after each had been individually double-checked by the architects. The manufacturer was happy to create a different liquid ceramic pattern for each panel, due to its advanced processes. The result is highly successful for users internally – as well as keeping spaces cool, "there are incredible shadows coming through the pattern," says Hopkins, which ties into the Japanese concept of 'forest bathing' which can reduce stress, benefit heart rate, and improve creativity.

The architects printed 1:1 paper examples of the panels on "huge rolls of paper" which Hopkins brought to the client in London; these were unrolled in the central void space to see how the patterns looked in the flesh. He then had to present to a panel, who decided to take the plunge.

Programme

As well as flexible, high-tech conference and events spaces, and several floors of teaching facilities, the building provides fine dining accommodation, and a cafe. The teaching function includes practical examination rooms in the form of 'simulations' of hospital wards for training medical staff. Says Hopkins, "We'd started off speculating what the range of functions might be, and that got refined over the course of six months."

Some of the departments in the college have moved in their entirety to the new Liverpool site (RCP taking the top four floors), such as the practical and written MRCP exams, whereas others are split between the two sites. The architects reviewed research on learning metrics, and found that exams done in a naturally lit space were associated with a 7%-9% increase in performance, and with a view that increases to 12%-13%. As a result the new exam facilities were naturally lit; not possible in RCP's London predecessor. The conference facilities are also a vast improvement, connected by audio visual networks and offering the facility to network across the London and Liverpool buildings.

The building is 15 metres from the core to the glazing, and the 3 metre floor to floor heights are slightly higher than a "traditional" commercial building, although natural ventilation wasn't possible. As Hopkins says, offering good space with commensurate natural light not only helps the users feel better, it also contributes to the achievement of WELL credits.

All of the permanent workspaces are within 7.5 metres of the perimeter, providing a view, meaning there was "no requirement to put in systems that simulated your Circadian rhythms," says the architect. There are three staircases, their attractive helical oak forms encouraging users to walk up from the ground floor to the connecting double-height spaces above. The lifts cores have been pushed to the north facade.

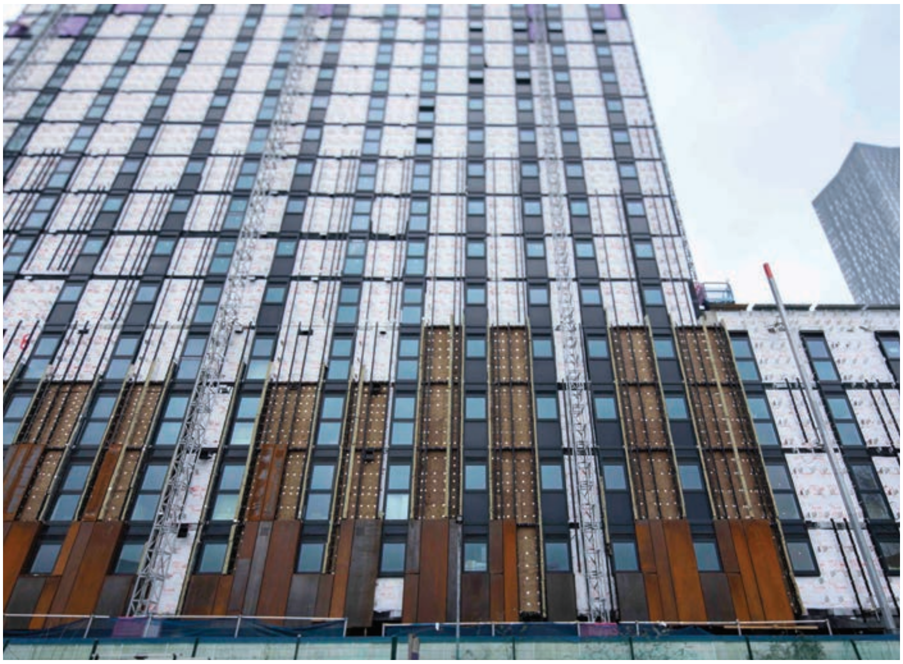
Conclusion

This was a demanding project for AHR, not least due to the unusually engaged, inquiring nature of the client. The result of all the hard work is a building which succeeds on all fronts for the Royal College. Also, the long-running wellness research project which constituted the briefing phase was worth the time invested for the practice, says Robert Hopkins, as it allowed AHR to "build up such a body of evidence." He adds: "We'll never again do so many things focused on wellness and health in a workplace, but there will always be some of those elements in every project we do."

With many of the students at the college likely to work in healthcare facilities worldwide, the architects hope they will share their experience of how the building itself helps deliver health, and apply the learnings in their own contexts. AHR is currently designing the centrepiece of the Paddington Quarter – a mixed use scheme called Hemisphere – raising the bar again from WELL Platinum to net zero carbon. ■

Sustainable fire safety

Kelly Westwood from Knauf Insulation discusses the critical need to combine fire safety and sustainability in buildings of the future



COP26 in Glasgow brought a renewed focus and urgency to the long-term sustainability of the built environment. This is reflected in updated Building Regulations, which came into force in June this year, as well as in the response by RIBA, which has set 2030 targets for operational and embodied carbon.

For buildings to be sustainable, they must also be resilient; i.e. designed to last, adapting to changes in use or tightening regulations. Fire safety must be considered one of the foundational pillars of sustainable design.

The impact of fire on sustainability

As well as the potential for injury and loss of life, building fires have a devastating impact on the environment. Fires emit CO_2 and other pollutants into the atmosphere and release chemicals that contaminate both land and water. This is evidenced by soil samples collected 140 metres from the Grenfell fire site. As long as 16 months after the fire occurred, they were found to still contain levels of carcinogenic chemicals and other harmful toxins 160 times higher than other urban areas.

As well as releasing pollutants, fire can destroy a building and its contents. In the clear up, fire-damaged materials are usually sent to landfill. New resources need to be used for the repairs or rebuild, accumulating more embodied carbon into the building's lifetime footprint.

Even if a fire never occurs, inappropriate fire design may necessitate remedial work, as is the case with the tower blocks identified in the wake of the post-Grenfell cladding scandal. Fire risk may even result in whole properties being deemed unsafe, leading to their premature demolition – something that is hardly sustainable.

Go beyond Building Regulations

It is essential that every building is designed to be fit for purpose throughout their intended lifespan. This means fire protection measures must not only meet the minimum standards outlined by existing legislation, but go beyond them to effectively future-proof the building – something that is already required for non-domestic buildings as part of the BREEAM In-Use certificate.

Building regulations already ban the use of combustible materials in the external walls of certain buildings over 18 metres in England and Wales (11 metres in Scotland). Key structural elements must also achieve a specified period of fire resistance to prevent the passage of fire from one area to another. This is achieved by designing the build-ups of the roof, walls and floors to compartmentalise the building.

As well as creating dedicated escape routes for occupants, compartmentalisation works in conjunction with sprinkler systems (if installed) to help limit the fire to a confined area. This minimises its spread and means it can be extinguished quickly, which reduces the scale of any repairs or rebuilding work required after the fire and the impact on the environment.

But problems occur if the structure has been compromised due to poor installation or by any damage caused to the building fabric post-occupancy. If combustible materials have been used within the build-up, it would then be possible for the fire to spread within the structure itself – with devastating consequences.

The simplest way to mitigate this risk is to specify materials such as non-combustible insulation regardless of the height or type of building. Look for the Euroclass reaction to fire classification, which measures whether a UKCA and CE marked material will ignite, produce smoke or flaming droplets. The ratings range from F (easily flammable) to A1 (non-combustible).

Mineral wool insulation as a standard specification

Of course, when designing for a sustainable future, architects must specify insulation products with minimum impact on the environment through either manufacture or use. But they also need to adopt materials and systems that reduce risk by preventing the development and spread of fire.

Mineral wool is non-combustible, having the highest possible Euroclass A1 or A2-S1, d0 reaction to fire classification. This is important because a product that does not combust will also not emit pollutants, as well as not contributing to the spread of a fire in a building.

This means that as a specifier, you don't have to compromise. As well as being non-combustible, glass and rock mineral wool insulation are made from materials that come from either naturally abundant sources or are recycled. In contrast, materials such as rigid boards are produced using oil-based ingredients. Glass mineral wool can also be compressed so there is more insulation per pack or per pallet, meaning fewer trucks on the road and therefore less transport emissions. This makes it ideal for projects where embodied carbon is a factor.

For buildings to be 'fit for the future,' it's not enough for fire safety to be considered from the point of legislative compliance alone, it must also be viewed as a measure of sustainability. Where insulation is concerned, there is a trusted solution for every application that already delivers on both criteria – non-combustible mineral wool.

Kelly Westwood is head of construction projects at Knauf Insulation

Fire safety must be considered one of the foundational pillars of sustainable design

Striking a balance

The importance of ventilation and ensuring a healthy and comfortable interior environment is an essential part of building design. Andy Moul from Construction Specialties (CS) looks at factors which need to be taken into consideration when specifying external louvres as part of a building's ventilation solution

Louvres are available in a wide range of designs, finishes and colours to suit any application

Ventilation design is a balancing act between delivering a high quality of air and thermal comfort, while maintaining energy efficiency standards and noise control. Ease of maintenance and long term operational costs of running the system add to the complexity. It's why external louvre systems have such an important part to play in ventilation strategies and their performance characteristics. In particular, airflow efficiency needs to be taken into consideration alongside aesthetic requirements.

Louvre specification

There are three main types of louvre systems available to specifiers, offering different design, functionality and performance characteristics. Simple and economical, screening louvres utilise a flat blade profile to provide airflow into a building and some rain defence. These are typically used at the top of buildings to hide unsightly HVAC systems or perhaps in car parks to allow for ventilation of exhaust fumes.

Ventilation louvres are chosen when airflow is a key consideration. They may provide adequate rain defence in light rain, but their performance generally falls short in wind-driven rain conditions.

When potential rain penetration is an issue, specifiers should consider rain defence louvres with integral water collection and drainage. These systems are designed to stop wind-driven rain entering a building, while allowing efficient passage of air. This is achieved through either a complex single-blade profile extrusion to give a slim louvre depth or a deeper, multi-bank system.

Required performance

Traditionally, louvres were specified based on a simplistic, physical 'free area,' which simply relates to the gaps between the blades in the louvre design that facilitate airflow, but this does not quantify airflow efficiency. Therefore, specifiers should be placing more importance on the design pressure drop and aerodynamic airflow efficiency. This is a true indicator of a louvre's performance, which ensures mechanical equipment has the required airflow to optimise function.

When it comes to the selection of a rain defence louvre system, third-party test data should be examined to ensure a project's functional requirements will be met. BS EN 13030:2001 standard is used for evaluating louvres' effectiveness against rain penetration as well as its airflow characteristics, and enables specifiers to directly compare the performance of the different weather type louvre systems.

All performance considerations such as required airflow, the maximum acceptable pressure drop, and the degree and depth of acceptable water penetration should therefore be balanced with the building's envelope design – hence the need for a 'form and function' approach.

Other considerations

A site's location and the position of louvres on a building is another important consideration in louvre selection, as exposure to prevailing weather conditions – in particular wind direction – will affect the amount of potential wind-driven rain penetration. In addition, Building Regulations Approved Document F recommends that ventilation intakes are positioned away from the direct impact of air pollutant sources, such as parking areas, loading bays or busy roads.

Exhaust locations should be chosen or designed to minimise re-entry of exhaust air into the building or having a harmful effect on the surrounding area. Finally, in some applications noise attenuation may be required in addition to other functional requirements and acoustic louvres could be considered for those situations.

Aesthetics

Louvres are available in a wide range of designs, finishes and colours to suit any application. A louvre system that uses hidden mullions, for example, gives continuous, 'architectural' lines because the support system is behind the blades, making the mullions almost invisible. Louvres with visible mullions, on the other hand, can be used as a design feature to line up with joints between exterior wall panels or with windows. These systems are typically supplied in a prefabricated modular form and are available in designs offering horizontal or vertical blade configurations. Some are available with frames designed to easily fit into glazing cavities.

There are three main types of louvre systems available to specifiers, offering different design, functionality and performance characteristics

Other design options include models utilising varying blade depths for added interest, or hidden behind decorative features such as perforated panels. Specification should always be supported with performance test data as such features can potentially increase louvres' resistance to airflow.

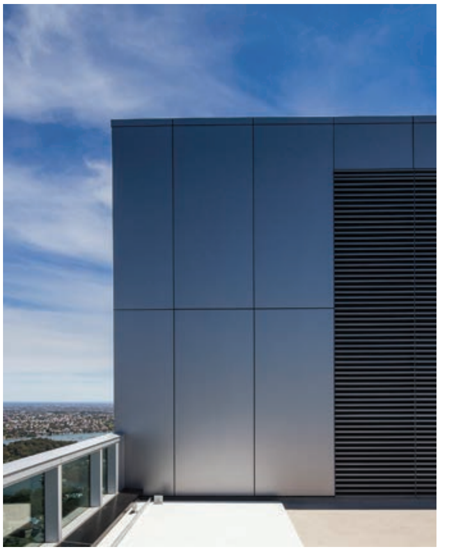
Great looks

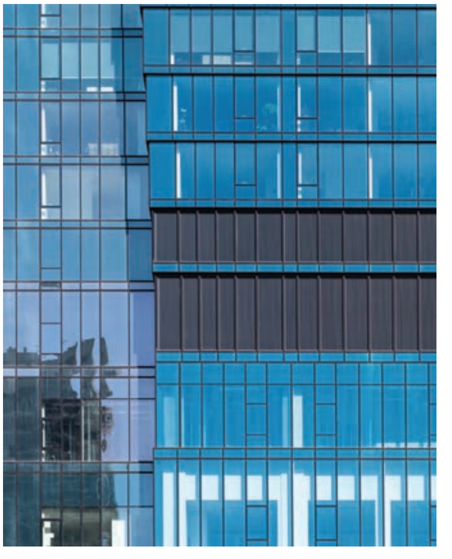
There are a range of architectural louvre systems that provide creative freedom to specifiers without sacrificing airflow performance. High strength and lightweight, these products are superbly effective for ventilation, screening and rain protection.

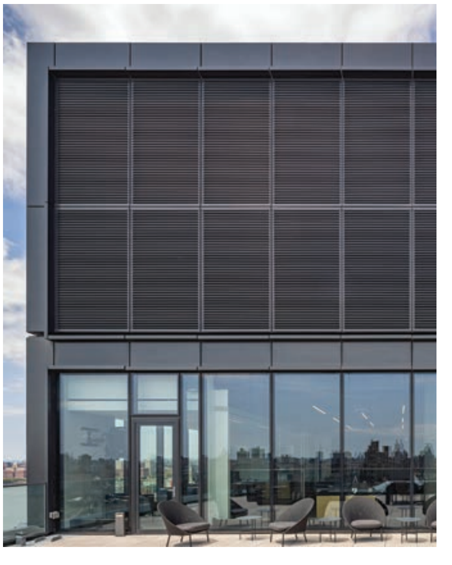
Due to their complex, extruded blade design, rain defence louvre systems are thinner than those relying on multiple banks of simpler blades and additional drainage, while offering some of the best combination of rain defence and airflow performance in the market.

For specifiers looking for an excellent way to address air quality and ventilation challenges in a wide range of buildings, louvres can improve a building's energy efficiency, lowering power consumption and thus reducing carbon emissions. They can also bring a high level of aesthetic value to a facade's design.

Andy Moul is technical director at Construction Specialties (CS)







A durable sustainability case

Sustainability needs to encompass long-term durability factors in addition to embodied energy to provide an accurate picture. Keith Aldis of BDA (Brick Development Association) explains how achieving this bolsters the eco case for brick

When considering the materials that may be used in a building's exterior envelope – one of the most critical elements for a structure overall – the cost effectiveness of each component and option is generally scrutinised, often over a relatively short time frame rather than for an extended building life expectancy. Through this simplified decision-making process there are often occasions where an individual component's actual life cycle is miscalculated, or incorrectly reflected.

Durability and longevity of the various material components can dramatically influence the sustainability of projects. The correct use of a material can extend a building's life, protect its other components, and be flexibly repurposed. To truly reflect the sustainability credentials of a building's envelope or an entire project, these factors would need to be considered, especially with products making up a significant portion of the structure. As the discussion around a circular economy grows and adapts it can seem difficult to achieve a true and fair comparison of potential material options. This is especially true when comparing new materials on the market that come with great sustainability credentials but have not yet been tested for durability or longevity. In addition to being an iconic part of our built environment's architectural history, traditional building materials have stood the test of time and can now offer us certainty as we navigate our way through how we look at the circular economy.

Standing strong

If you take a look at the components used in many of the UK's historic buildings and high streets, it is clear that brick has a track record of not only lasting a very long time but ageing beautifully as well. A well designed and constructed brick building has a typical lifespan of 150 years or more. Currently, materials are certified under the assumption that all material components will have a lifespan not exceeding 60 years.

Brick's track-record offers certainty that the material will exceed this lifespan, which is important because even with the most efficient and sustainable processes and testing in place, all materials need to stand the test of time. When a completed home or development is made with materials or a mix of the wrong components it will require significant maintenance or may be demolished all together, a process that is wasteful, expensive and not sustainable when looking into the longer term.

Where materials come from and the distance they travel to a building site or through their own production is also an important aspect when looking at building more sustainably. For example, clay brick is produced in ample quantities across the UK at over 56 locations to satisfy the growing demand for new quality-built homes and buildings. Using locally sourced products made in the UK significantly reduces transport costs and the carbon emissions involved in the delivery of these products.

On average clay brick produced in the UK only travels 67 miles from production to building site. When comparing transport costs and emissions to alternative materials, that often include multiple components which are shipped across the globe in the process, locally produced sustainable building materials are instead available.

Adaptability & resilience

A material's adaptability and resilience contribute to its sustainability in a similar way. Attributing sustainable credentials to developments based on the ability to easily deconstruct them and send its various used components through laborious recycling processes is flawed. Unfortunately, as a society we have not come far enough to make many of these processes viable. We are slowly beginning to challenge these processes, but they will not be fixed or easily replaced with more viable options. The follow-on impact of transporting components and the process of reconstruction on overall sustainability is extraordinary.

The resilience of clay brick can ensure that a building can withstand the wear and tear of multiple occupiers, and through intelligent design, and brick's natural flexibility as a building material, these buildings can be easily adapted for multiple uses over decades or even centuries. Coupled with the sustainable process of locally sourcing material and a short supply chain in the manufacturing process, clay brick continues to be a sustainable option as it produces aesthetically pleasing homes that are enjoyed for generations.

One of the areas that we in the construction industry will continue to focus on is the longevity of the housing stock being approved and promoted by the UK government. Recent discussions and campaign pledges on new homes have been focused on the need for volume and speed, but on their own these elements won't address the issue of available, affordable housing long-term; if the longevity of the housing isn't prioritised, we will continue in a cycle of requiring heavy maintenance and the demolition of poorly built homes and buildings in our communities within a lifespan of less than 60 years.

Naturally, brick has a high thermal mass giving it the ability to absorb, store and release heat energy. Thermal mass can be used to even-out variations in internal and external conditions, absorbing heat as temperatures rise in the day and releasing it as they fall which makes for a more comfortable atmosphere which is naturally regulated, reducing the need to mechanically heat and cool a building.

The need for sustainable products comes from a growing population who will always need somewhere to live and work. The push for so-called 'modern' materials and fast construction risks undermining this unless quality is insisted upon. Perhaps this is why recent ONS stats show that UK brick producers have sustained a consistent rise in deliveries for new developments in the past 12 months, as the focus of a circular economy grows and a building's longevity and future flexibility is considered alongside each of its individual material components.

Keith Aldis is chief executive at the Brick Development Association

As the discussion around a circular economy grows and adapts, it can seem difficult to achieve a true and fair comparison of different material options

The changing faces of facades

Philip West from Spanwall discusses the future of facades and how technology and legislation have created a new set of design expectations throughout the industry

In the wake of unprecedented change, manufacturing firms across the globe are being forced to rethink how they design as events over the past few years cause a massive shift in design trends. The end user's needs, which had become somewhat familiar to architects throughout the years, have dramatically changed, bringing with it a whole new set of design expectations.

This shift has provided designers with an unprecedented opportunity to create new innovative ideas that are shaking up traditional industry standards.

When designing any building, the facade is arguably the most important (and difficult) element. Not only does a building's facade create the essence of an iconic building, but a well-designed facade has a monumental impact on how a building will operate, from both a structural and environmental point of view.

The constant advancement of technology is a main driving force in facade design, creating intelligent solutions to previous project-stalling challenges. Manufacturers have always been at the forefront of innovation, but now, driven by legislation and new design trends, facades are becoming even more sophisticated, fuelled by ground-breaking innovations.

Sophisticated software continues to transform the design landscape, creating a more streamlined and collaborative design process. Blueprints which were notorious for taking weeks to approve, due to inefficient processes, can now be easily accessed by all individuals within the design process – enabling all edits to be instantaneously signed off.

What were whispers of technology-driven builds have blown up into industry-wide conversations with things like generative design and robotic construction now being put on the table for consideration as manufacturers look for better ways of doing things. For facade designers, who regularly work with complex design requirements, the idea of an algorithm that predetermines design requirements, and produces a range of possible options based on these, certainly

merits serious consideration.

Smart buildings will continue to grow, with designers incorporating smart elements into facade designs creating products that are adaptable, durable, and intelligent – adding more value and functionality to buildings.

Sustainability will remain a key focus in the industry, from design concept stage right through to design development as firms continue to face increased pressure to incorporate more sustainable materials into their buildings – without compromising on the aesthetics or functionality of the design. Issues such as facades' longevity will also be critical in ensuring a more sustainable build.

To a large extent, the exterior facade controls the energy use of any building. New legislation, which has been fuelled by the increasing need to reduce the carbon footprint of new developments, will see energy efficiency continuing to be an important factor in project design.

The next step in design innovation is to

When designing any building, the facade is arguably the most important (and difficult) element

The next step in design innovation is to find ground-breaking ways for facades to generate energy

find ground-breaking ways for facades to generate energy themselves. Solar panels have already been used to great success and it seems inevitable that research will develop new technologies for energy generation in the future.

Performance testing is paramount in facade systems, especially during the design stage. Fire safety has recently become a subject of nationwide concern, pushing for tougher legislation on building and fire safety. More accountability and new regulations will mean fire safety will be a key element when considering any facade design alongside the need for a better understanding of how buildings will operate under certain stresses, such as weather. Firms will need to adopt a holistic approach to any project, considering the wider building components to ensure a safe and comfortable build.

Pre-pandemic, ventilation was already a much-talked about topic when designing buildings, however the Covid-19 crisis, which saw people forced indoors, has brought these discussions to the fore in any planning conversation. As the need for good ventilation systems intensified, it has forced designers and manufacturers to look for better ways to create a healthy environment that safeguard a user's health and wellbeing and we can expect future designs to incorporate elements that encourage improved air flow within the building.

The facade is the main external expression of architectural intent and although we are already seeing architects and developers become more ambitious in their design ideas, new design capabilities will drive even more complex creations, with an increase in curvilinear, free-forming architecture.

To conclude, the facade of the future will be responsive, innovative, and high performing and will play a crucial role in creating more sustainable buildings.

Philip West is sales director at Spanwall

Biotecture's hydroponic living walls bring benefits for people and planet

Bringing nature into our cities is a vital component for a sustainable future to help mitigate the effects of climate change and improve wellbeing. Living walls are a space efficient way to green up our urban areas and bring a host of benefits including improving air quality, helping mitigate the urban heat island effect and increasing biodiversity.

In addition, Green Infrastructure can help to meet CSR targets, satisfy planning requirements, and demonstrate sustainable credentials.

Biotecture's patented hydroponic BioPanel™ system is the most flexible, resilient, and low water use of any fully comprehensive living wall system anywhere in the world. A comprehensive independent engineering assessment with regards to reaction to fire confirms a system rating of B-s2,d0 which means the BioPanel™ living wall system can be retrofitted as part of a façade refurbishment and incorporated within new buildings as the integral rainscreen cladding element.

The system is fully tested in accordance with the requirements for the Centre for Window and Cladding Technology (CWCT) and passed all tests for weathertightness, water resistance and wind resistance, confirming its full suitability and compliance for use as a cladding material for commercial and residential buildings.

BioPanel™ combines efficient water management with remote sensing technology, which enables Biotecture to work with

confidence in all climates.

With 15 years' experience in designing, supplying, installing, and maintaining sustainable living walls, Biotecture has established itself as the go-to partner for vertical green infrastructure and they have supplied living walls on projects as diverse as 20 Fenchurch Street (The Walkie-Talkie), Wimbledon's No.1 Court and Canary Wharf.

01243 572118 www.biotecture.uk.com

Sustainable restoration with Nordic Copper

Although a thoroughly modern material offering limitless possibilities for contemporary architectural design, copper is also – of course – one of our oldest building materials, covering the domes and spires of city skylines. Nordic Copper Special Patina has been developed specifically to help with repairs, restoration or extensions to historic copper buildings.

Copper's unique architectural qualities are defined by different stages of oxidisation and patination, which can take decades to develop. But the 'Nordic Copper' range provides them straightaway and the factory processes involved are generally similar to those taking place over time in the environment – utilising copper mineral compounds, not alien chemical processes. The surfaces form an integral part of the copper, generally continuing to change over time, and are not lifeless coatings or paint.

With Nordic Copper Special Patina, unique pre-patinated copper material can be produced to match naturally patinated copper, especially for historic buildings. An original sample taken from the building is used but initial development can be started with photos using the Special Patina Tool (from www.nordiccopper.com). Once a specific patina mixture has been established and product supplied, the project mix is retained in case of follow-up orders.

Aurubis can also recycle the original copper removed from a project. Copper's ability to be recycled repeatedly, without any loss in performance, is an important sustainability benefit. All Nordic Copper architectural products are manufactured using 100% recycled raw-material and Aurubis is part of the world's leading integrated copper group and largest copper recycler.

A growing series of 'copper stories' – building studies exemplifying the best in contemporary architecture – showcase the diversity of surfaces, forms and applications available with Nordic Copper today.

g.bell@aurubis.com www.nordiccopper.com

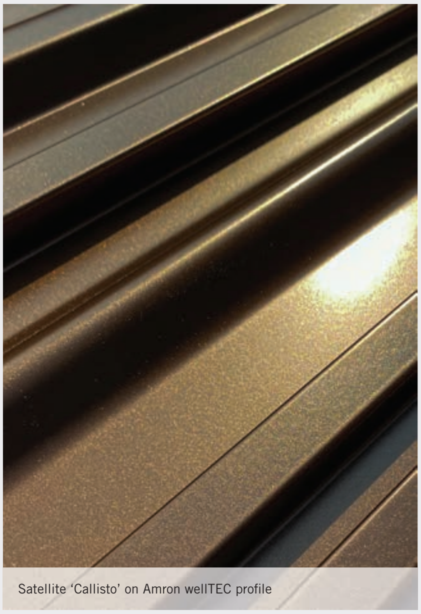
'Satellite' – Powdertech's unique lustrous finish with an iridescent gleam

Powdertech (Corby) Ltd has launched its latest powder coating Collection, 'Satellite'. The range is made exclusively for Powdertech to the company's visual and technical requirements and conforms to BS EN 12206-1 standards and Qualicoat specifications.

These finishes have mesmerising metallic and pearlescent effects with a depth of colour unrivalled in a one-coat application. The mid-sheen finish, with vibrant flashes of light set in a rich colour, is so intense that it looks like a million satellites in the sky, hence the name.

Development of the range arose from a casual conversation between Powdertech and Amron Architectural, one of the leading players in metal mesh for architecture and interior design.

Richard Besant, Director at Powdertech, explains: "Amron mentioned the frustrations of anodic coatings and the difficulty in finding a powder coating that offers a similar depth of colour and layered iridescent effect to anodising. That set us thinking, and the result was the Satellite range, launched this month."

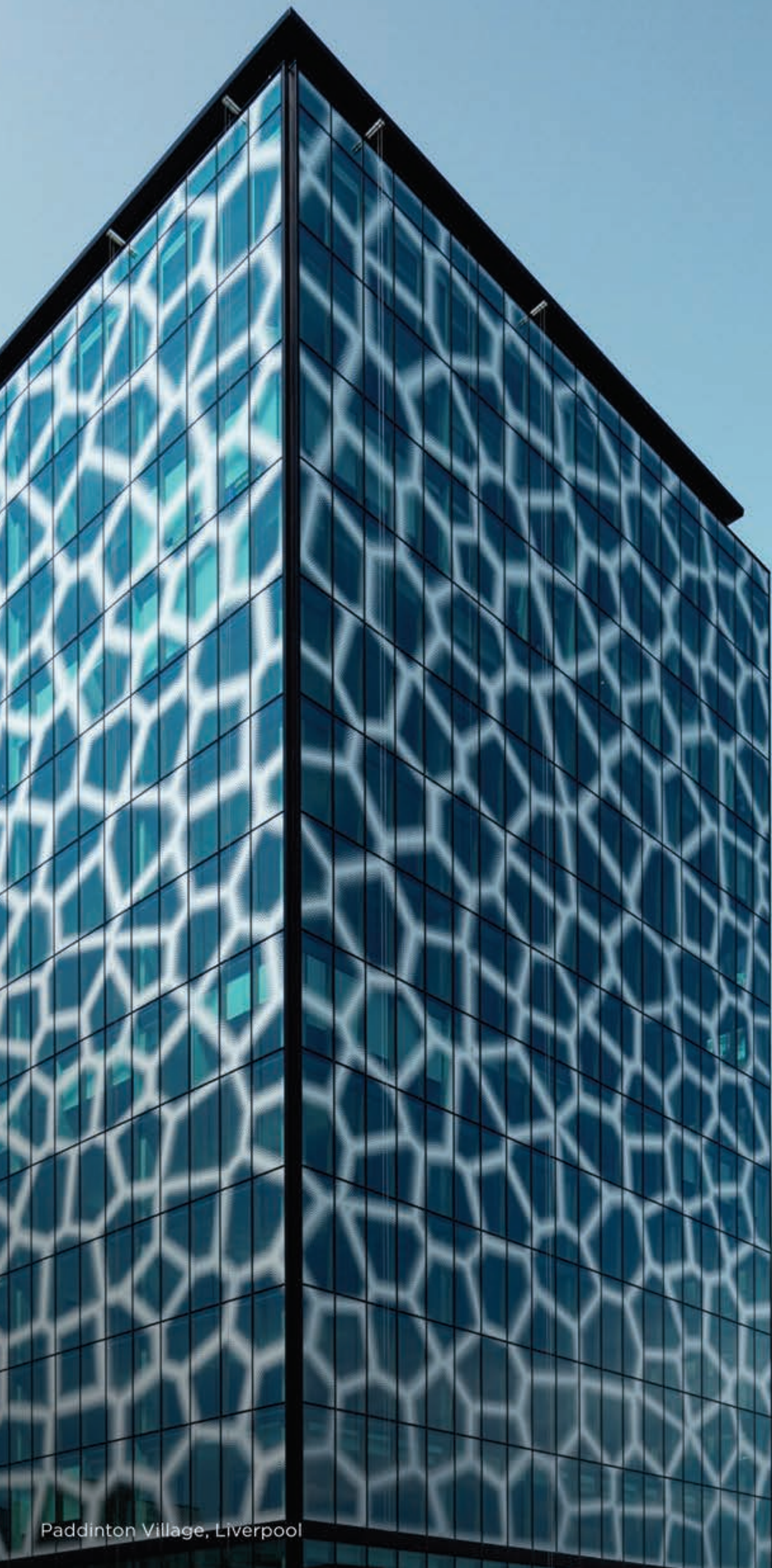


Satellite 'Callisto' on Amron wellTEC profile

Amron is delighted with the range and used it, pre-launch, on the profiled sheet walls of the company's stand at the Surface Design Show in February. Using 'Callisto' from the Satellite range, the undulating surface of the profiled sheet was wonderfully enhanced as light bounced off the glittering finish.

Satellite finishes are suitable for internal and external applications and can be applied to most metallic substrates. It is a range that stands alongside anodising, bronzes and golds as a high-quality, flexible, unique and economic finish with excellent durability and colour stability. Samples can be ordered through the website at www.powdertechcorby.co.uk/services/colour-library/satellite

01536 400890
www.powdertechcorby.co.uk


Paddinton Village, Liverpool