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Metal in architecture supplement

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FROM THE EDITOR

Hello and welcome to this special supplement to *ADF*, devoted to the subject of metal in architecture, and illustrating what's possible with what we think are some really interesting project case studies from around the world.

In particular, we're delighted to feature a couple of major international practices as our project reports in this supplement. Firstly, Bjarke Ingels Group (BIG), working with Boston firm Goody Clancy, created an addition to a university campus in Amherst, Massachusetts, which is finished with dynamically-angled copper-clad pillars, creating the effect of tumbling dominos.

This kinetic form shows off the potential of copper, but also forms a three-quarter ring as it terminates a portion of the site, thereby creating a useful internal courtyard for students. What is a fairly straightforward building suddenly warps and twists at one end as the ingeniously angled facade becomes something far more playful and exciting.

Also in this supplement we feature a copper-hued project by a leading international name – Heatherwick Studio – however in this case it's steel, finished to look like copper due to the project requirements. This is an entirely unusual, some might say quirky scheme which has certainly raised eyebrows since its completion.

Vessel sits in the centre of the mammoth Hudson Yards development in the west of Manhattan, at the start of the now much-loved High Line urban green walkway – a former freight railway line. Heatherwick created what is essentially a giant outdoor staircase, forming a futuristic yet also honeycomb-like structure, to provide further public space in this increasingly dense urban district, and a great viewing platform.

No doubt accurately described as a symbol of New York's current affluence, this structure also adds a new, free public asset in what is increasingly a privatised, intensely commercialised city. For that at least, as well as its striking, shining copper surfaces, it's something to be cheered.

Our product features also contain a wealth of interesting metal discussion, for example on the 'renaissance' in metal ceilings, which is the subject of a piece by Knauf AMF. This is not only on aesthetics, but also sustainability grounds, as much of steel is recycled.

We hope you enjoy this supplement.

James Parker
Editor

ON THE COVER...
Vessel by Heatherwick Studio in Manhattan's new Hudson Yards Development has been clad using Physical Vapour Deposition (PVD) to create a durable copper-like finish to the structure.

For the full report on this project, go to page 30.
Cover Image © Michael Moran for Related-Oxford

ALUMINIUM

Emulating US ‘tobacco barn charm’

Picture: Tim Hursley / Products: Lorin Industries'

Coil-anodised aluminium offers a unique set of benefits to architects who are in the market for something very specific

Tasked with designing the new Convention Centre for Owensboro, Kentucky, Brad McWhirter of Trahan Architects dreamt of “tying his modern architecture to the antique flavour of the region”. However, he said, “the picturesque tobacco barns that dot the surrounding farmland and define the area’s aesthetic roots could not simply be imitated – “their essential wood material would not perform for a modern community hub”. He sought a replacement, “but what material could reflect woodgrain and match the right colours while providing exceptional architectural performance?”

Matching colour with performance

In addition to his aesthetic goals, McWhirter required Exterior Architectural Grade Class I performance. He considered a number of options, but “had no answers by the time he ran into a familiar face at a trade show”. When the architect resurfaced the Louisiana Superdome after Hurricane Katrina, Lorin Industries supplied 365,000 ft² of anodised aluminium, “carefully colour-matched to the original hue of the historic stadium”.

Coil-anodised aluminium offers a unique set of benefits to architects who are in the market for something very specific. Controlling the oxidation process through continuous coil anodising creates a clear, translucent aluminium oxide layer that shows off the beauty of the natural metal. The resulting anodic layer can be coloured, with the continuous coil process delivering a consistent tone.

Emulating woodgrain with anodised aluminium

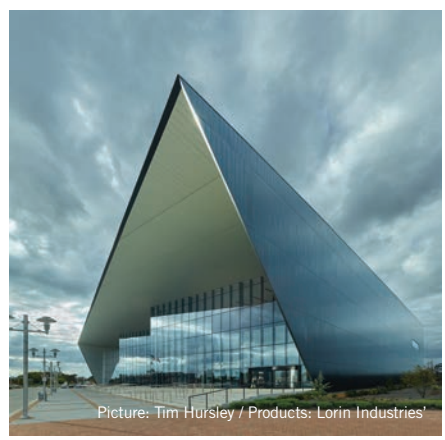
However, to truly emulate the tobacco barns, more than just colour would have to match. Integrating the material into the sleek design while revealing a wood-like texture required careful coordination with the panel manufacturer. “The Long Line Brushed finish of the anodised aluminium reflects light in much the same way textured wood does.”

Sharp, angular wings mark the north and south ends of the Convention Centre, “posing a particular challenge to ensure a consistent vertical grain look,” said the architect. These pieces “fit tightly into a seamless smooth exterior, achieving the angularity of the buildings that inspired the structure, while ensuring the effect of grain was not lost,” commented McWhirter.

As barns fade

170,000 ft² of coil-anodised aluminium was supplied for the interior and exterior panelling, allowing the project to successfully “reinterpret the region’s historic barns with tonal and textural flair while protecting the project with high-performance material”. Unlike the structures that inspired the award-winning Owensboro Convention Centre’s design though, it will not fade with time. Instead, it is built for durability. The crystalline aluminium oxide layer on the panels belongs to the same family of gemstones as sapphire, and “is second only to diamonds in terms of hardness”.

Architectural Grade Class I panels provide at least .007 inches of anodic layer for increased protection and greater longevity. The anodised layer is designed not to chip, flake or peel, and while wood could not have succeeded for the project, the project will “stand as a durable testament to the humble architecture that inspired its design – and will continue to inspire pride in the local community”.



Picture: Tim Hursley / Products: Lorin Industries'

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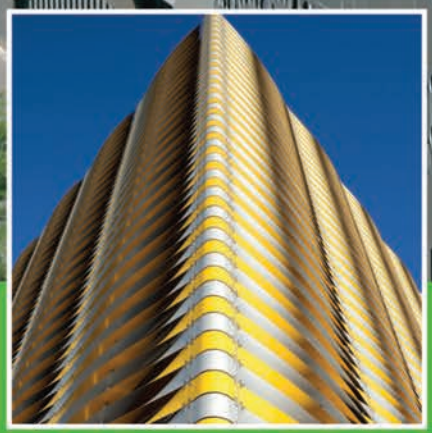

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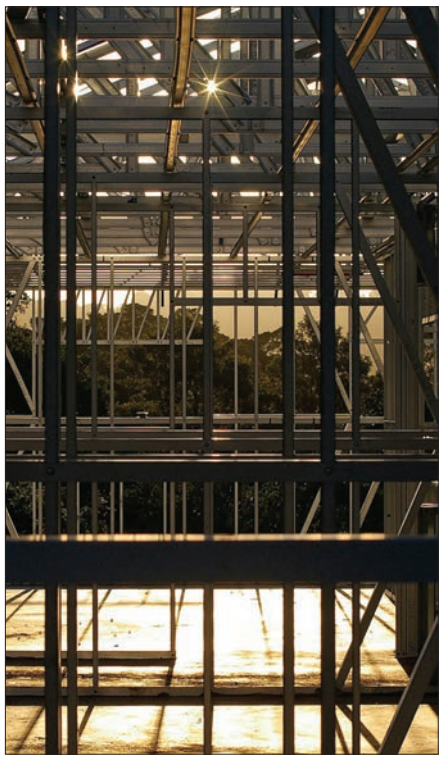

LIGHT STEEL FRAME ASSOCIATION

STEEL

Steel, sustainability and the circular economy

The Light Steel Frame Association (LSFA) is "on a mission to ensure that all construction professionals are fully aware of the sustainability benefits and recognise that steel is the only permanent building material in the circular economy". When considering sustainability in construction, said the LSFA, "steel may not be the first building material that comes to mind." However it added: "After water, steel is the most recycled product on our planet, with research showing that 99 per cent of structural steelwork is reused or recycled."

A sustainable circular economy reduces the burden on nature by ensuring resources remain in use as long as possible. Steel is fundamental in achieving a circular economy – components can be manufactured, reused or recycled. With a long service life, we may have to wait a hundred years or more for steel that is in use today to be recycled or reused. Steel is a vital material in the history of construction and although it may not be in our lifetime, every single element can be repurposed.

Design for reuse

It is estimated that the UK construction industry consumes some 420 metric tons of materials annually and generates some 90 metric tons of waste of which 25 metric tons ends up in landfill. So, there is significant scope for improving resource efficiency within the industry.

"Recycling is the mantra of the 21st century and rightly so, but reuse for its original or similar purpose without vastly altering the physical form, is not top of the construction sustainability agenda," said LSFA. As distinct from recycling, reuse of construction products involves their repurposing with little or no reprocessing. Reuse offers even greater environmental advantages than recycling since there is no, or few environmental impacts associated in reprocessing.

As with recycling, some construction products and systems are more adaptable to reuse than others and "therefore designers should be encouraged to think not only about how their buildings can be easily and effectively constructed, but also how they can be efficiently deconstructed in the long-term. This is a new discipline for most designers."

The process is straightforward. For example, deconstructed sections are inspected and tested to verify their dimensional and strength properties. The section is then shot or sand blasted to remove any coatings, refabricated and primed to the requirements of the new project.

"There is, however, significant scope for increasing reuse of steel construction products and work is underway within the sector to promote and facilitate this," said LSFA. "The proportion of recovered products that are reused will increase as design for deconstruction is better understood and a stronger market for reusable steel construction products is stimulated. The ability of the steel sector to facilitate these advantageous processes has been enhanced by the standardisation of components and connections."

Research carried out by the LSFA's technical partner, the Steel Construction Institute (SCI) has estimated that there are around 100 million tonnes of steel in buildings and infrastructure in the UK. "This 'stock' of steel is an important and valuable material asset that will be reclaimed and either reused or recycled in the future."

The Light Steel Frame Association "fully supports the Protocol for Reusing Structural Steel produced by the SCI". It added: "This valuable research concludes that the environmental advantages of reusing reclaimed structural steel are considerable. There are also potential cost savings. This protocol recommends data collection, inspection and testing to ensure that reclaimed structural steelwork can be used with confidence in a new context.

The LSFA concluded: "There is growing pressure on the construction industry to be more resource efficient, reduce waste and to lower embodied carbon impacts. More recently, circular economy concepts are being promoted, with a roadmap developed to support a shift towards a resource efficient, low carbon economy. Increased structural steel reuse will support these aims and stimulate new business opportunities in the UK."

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BRASS

Brass facade revitalises refurbished Norfolk Arts and Heritage Centre

Wells Maltings, a former 19th century malt house in Wells-next-the-Sea, has undergone an award winning refurbishment and extension by architects Chaplin Farrant, in a bid to "revitalise the building and turn it into North Norfolk's premier Arts & Heritage Centre".

The choice of facade material for the newly-built extension was critical to the project. Proteus HR TECU Brass was specified because it created an aesthetic that was distinct yet sympathetic with the Grade II listed brick and flint walls of the existing building.

The material will gradually mature over time to "warm earthy tones," creating an aesthetically pleasing patina that will continue to complement the original brick and flint walls on the Malthouse.

The brief to the architects was to create a new, year-round destination for artists, locals and tourists that serves as a cultural heart of the community. The designers created a flexible space that is used by a diverse range of groups, as well as maintaining the heritage of the existing Maltings. A new glazed full-height atrium acts as a buffer between the two distinct structures with an expansive roof lantern that floods the space with natural light.

The brass-clad extension is a similar size to the original building and now "announces Wells Maltings as one of Norfolk's most significant new architectural designs".

Featuring vertically elongated Brass rainscreen panels on the facade with a traditional handcrafted zinc roof, the new art building is a striking design that establishes a new identify for the whole town. Clever detailing between the brass panels and zinc roof "offers a seamless transition between the two elements, removing bimetallic corrosion challenges and providing a modern twist to a historic building".

Wells Maltings remains a historic building but "with a twist; a striking example of how old and new architectural styles and materials can work together," said the architects. The completed project creates a cultural landmark and an inviting, contemporary community space featuring a state-of-the-art theatre and cinema, Heritage Centre, Visitor Information Centre, attractive cafe and bar and art gallery.

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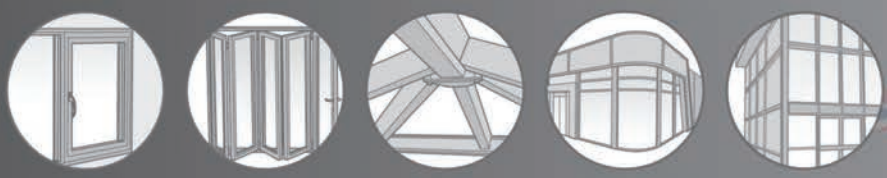

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BRASS, ZINC AND ALUMINIUM

London mixed use redevelopment features metal mix

A combination of solid and perforated brass, zinc and aluminium cladding panels create a striking finish on the redevelopment of 24 King William Street, a new mixed-use office scheme in central London.

The £23m renovation of the 80,730 ft² building, located on the northern approach to London Bridge, was designed by Ben Adams Architects and includes the addition of two new storeys, and Grade A office space.

An elegant reception area comprises a double-height entrance hall leading into a lift lobby, finished with Portland stone floors and feature walls in marble and leather, with brass accents throughout. To reflect the style within, striking perforated Proteus SC TECU Brass panels and bespoke vertical fins and trim flashings, a copper and zinc alloy with a hand applied patinated finish, were specified for the ground level, street facing elevations.

The fins are designed around a rigid bespoke aluminium extrusion that connects to the curtain wall glazing system. The outer brass element of the fins are profiled and taper across the length to generate an angled effect – the fins extending further as they ascend - whilst the connection of the material to the extrusion and the window frame remains constant.

Their internal aluminium structure provides the necessary support and structural connection back to the curtain walling. This also created a depth at the rear, hiding the curtain wall system from plain view and giving passers by the perception that the fins float in front of the glazing system.

The combination of thin gauge brass material and internal aluminium support framework ensured that this element of the facade met budgetary requirements. The folding requirements of the fins were "towards the limits of current bending technology," said Proteus.

Perforated panels were fixed over insulated spandrel panels within the curtain wall system, hiding the ventilation elements of the curtain wall and blending the fins and curtain wall system. The patination effect finish was created by applying a fine orbital grain brush effect to the face of the material before chemical application and sealing. The panels will gradually weather over time and continue to embellish and enhance the finish.

The rear elevation of the nine-storey building features an equally impressive zinc facade (Proteus HR Graphite Grey Rheinzinc rainscreen panels). It wraps up and over, forming a curved zinc roofing system which blends vertical and horizontal elevations into one. The material is "gaining favour with architects and developers as it provides a long, maintenance-free life and offers adaptability to various design styles ranging from traditional to modern," said Proteus.

Once dominated by rambling plant rooms, the interior of the zinc roof is now home to state of the art offices overlooking the City and the River Thames. A limestone facade on the front of the building connects to the roof through perforated flat sheets in a bespoke finish. These are also integrated within the windows on the top two floors, and then flow up and onto the roof generating the patterned effect, "while making it look like the facade and roof are one element".

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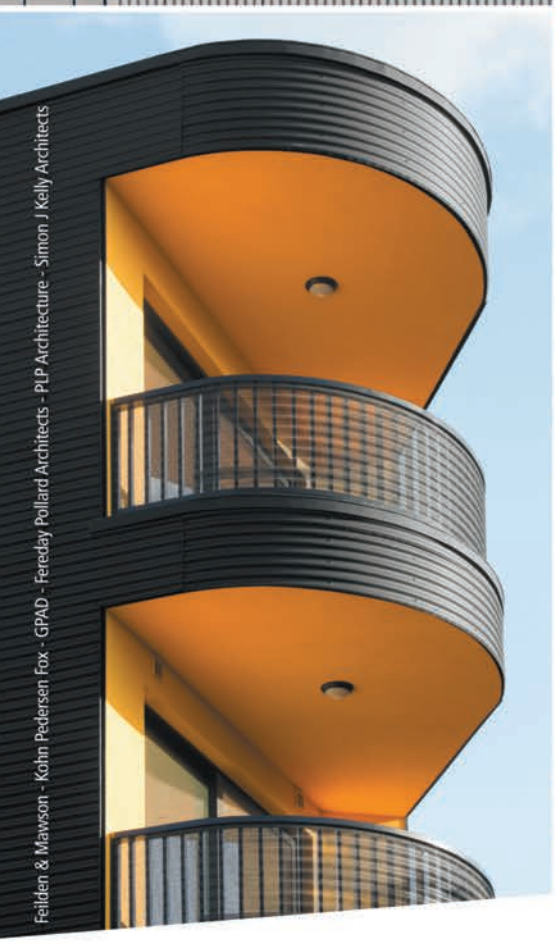

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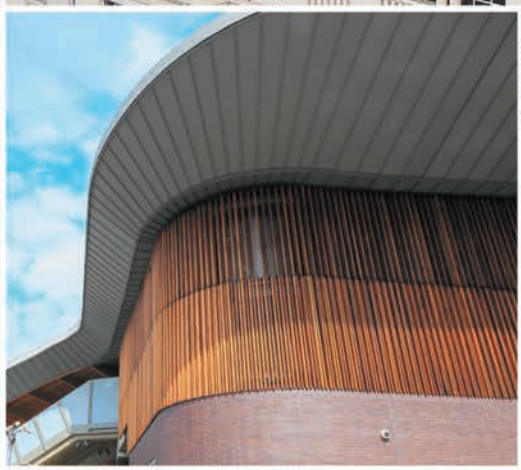

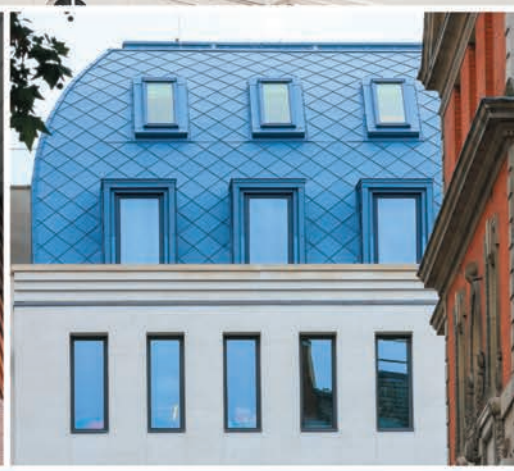

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ALUMINIUM

Cast aluminium building completes in London

The Compton, one of the world's first cast aluminium clad-buildings, has reached completion. Commissioned and built by Regal London, the 10-storey residential building delivers 49 "progressively designed" homes in one of London's most prestigious suburbs, St John's Wood. The development is located just a three-minute walk from two of London's most renowned attractions, Lord's Cricket Ground and Regent's Park.

The architecturally striking apartment building has been designed by Simon Bowden Architecture to "embody innovation and elegance". The facade is constructed from recycled cast aluminium, which was selected for its adaptable properties, culminating in a distinguished overall appearance.

Inspired by the greenery of nearby Regents Park, the series of undulating bays are embossed with an intricate leaf motif that "gives an impression of texture and delicacy"

Inspired by the greenery of nearby Regents Park, the series of undulating bays are embossed with an intricate leaf motif that "gives an impression of texture and delicacy". This stylised pattern unifies the building "and reoccurs on a larger scale in the fretwork at the lower part of the building.

Specialist cast metal manufacturer AATI were enlisted to assist in the development and manufacturing of the panels. A quality assurance benchmark was created so that if during transit or installation any scratches or chips were deemed too severe, the panels would be rejected and replacements would be manufactured. Specialist foil packaging and handling guidelines were even devised to protect the panels and, of the 1,800 panels made, just two were rejected.

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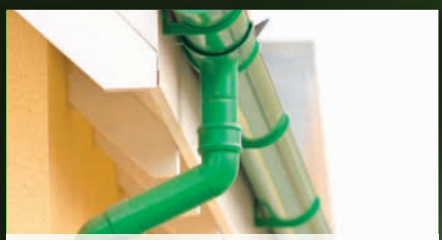

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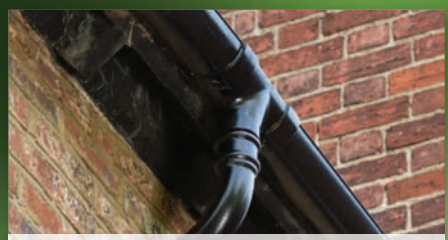

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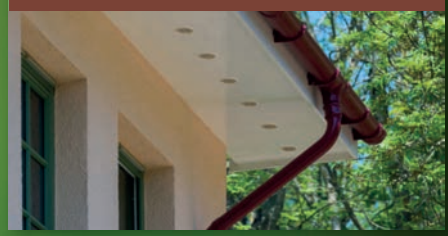

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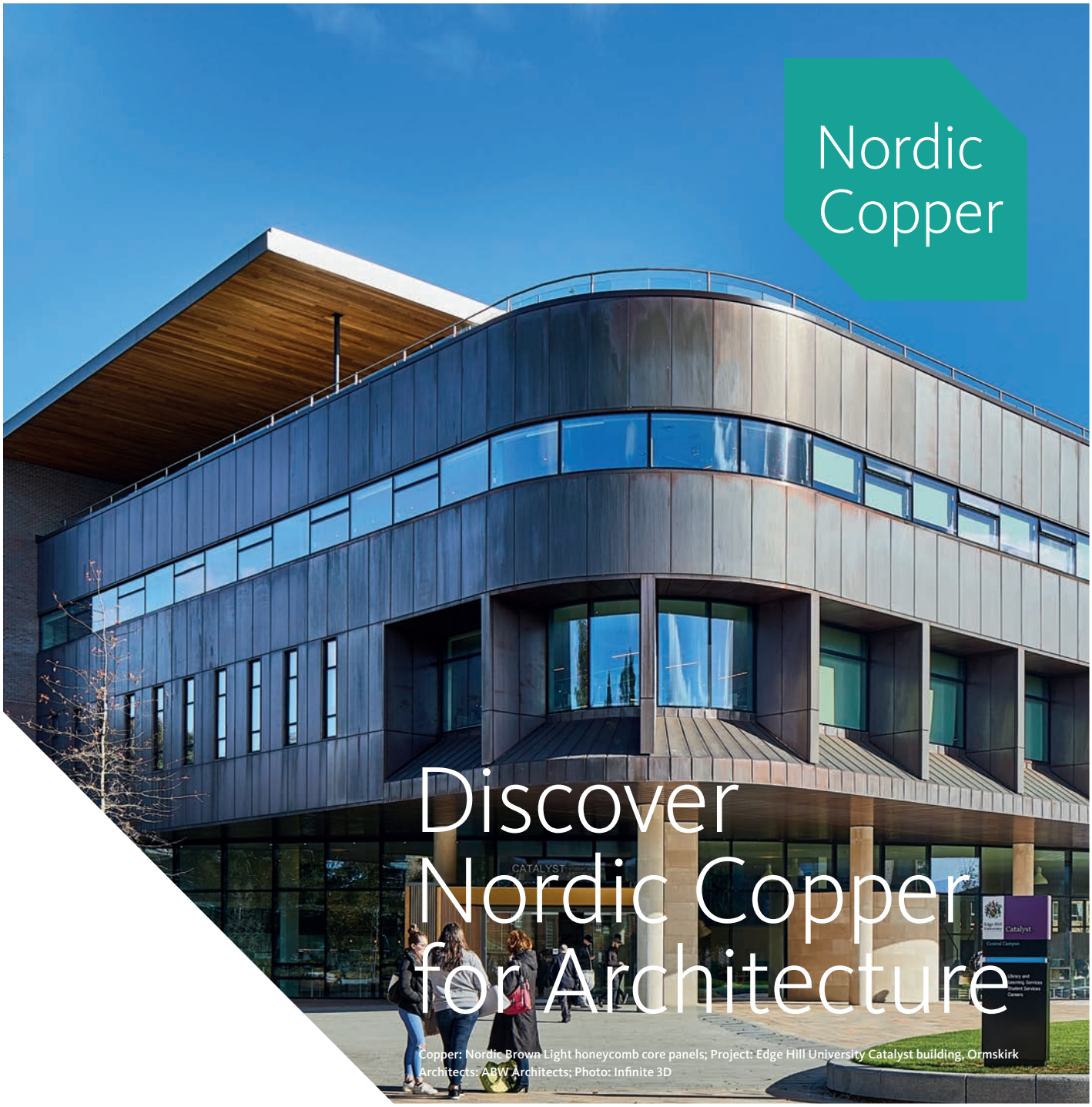

Copper: Nordic Brown Light honeycomb core panels; Project: Edge Hill University Catalyst building, Ormskirk
Architects: ABW Architects; Photo: Infinite 3D

Architectural Copper Surfaces and Alloys

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COMMENT

An internal monologue on copper

Copper has seen a dramatic change in use from its historic place roofing prestigious buildings to being a thoroughly modern external skin for contemporary architecture. But its role as an interior surfacing material is also growing, presenting new opportunities and challenges, explains architect Chris Hodson

Architectural copper is characterised by the natural development of a distinctive patina with colours changing over time, dependent upon local environmental conditions and air quality. Within a few days of exposure to the atmosphere, the surface begins to oxidise, changing its colour from the 'bright' mill finish to a chestnut brown, which darkens over several years to a chocolate brown.

A complex combination of factors determines the nature and speed of development of patina externally. Continued weathering can eventually result in the distinctive green or blue patina seen on older roofs. Some rainwater is needed for the patina to form and its rate of development will depend on the water 'dwell time' on each surface. So, vertical cladding and sheltered surfaces will take much longer to patinate naturally than exposed roofs – while protected areas such as soffits may not patinate at all. Obviously, copper used internally and away from the outside environment will not change and develop in this way.

Modern factory-applied surface treatments can provide 'straightaway' oxidisation and patination of copper surfaces to a selected level. Essentially, they bring forward the environmental changes without taking away the integrity of copper as a natural, living material and are not coatings or paint. It's important to remember that on-going changes to pre-oxidised and pre-patinated copper, as well as alloys such as brass and bronze, will continue over time depending on the local environment. Again, this does not generally apply to interior applications.

Copper and its alloys already enjoy a long heritage inside buildings, contributing a distinctive tactility to door furniture and handrails, and visual richness to lighting and other fittings. Now they are also used as high-quality coverings for walls, doors, ceilings and other interior surfaces, exploiting the materials' inherent antimicrobial and fire-safe performance. Internally, copper can be used in a wider range of forms, enjoying freedom from the constraints of weather-proof detailing.

Having said that, material continuity is a recurring architectural theme, with external copper cladding continuing inside, simply separated by glazing. Here, it is essential for designers to understand and, indeed, celebrate the divergent developments of internal and external copper. This approach is demonstrated in a recent

INTERIORS
The redevelopment of Onslow House Guildford, designed by architects AWW, uses copper cladding to link outside and interior spaces © CGL Facades

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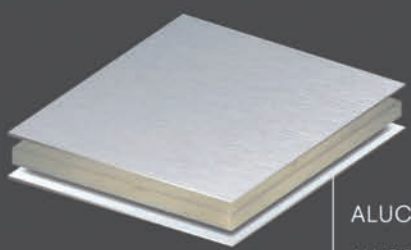

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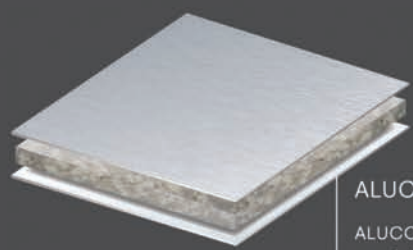

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For rear-ventilated façades, we recommend ALUCOBOND® PLUS (EN classes B-s1, d0) or ALUCOBOND® A2 (EN classes A2-s1, d0) in combination with non-combustible mineral insulation. This combination shows no flame propagation or critical temperature rise, and even exceeds the requirements of BR135.

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SPA SURFACES
The Bürgenstock Spa Hotel near Lucerne, designed by Berlin-based architects plus 4930, includes copper interiors with enhanced surfaces © Olaf Rohl

commercial HQ redevelopment in Guildford.

Here, the updated, glazed entrance atrium now incorporates feature walls – including inset doors – faced with horizontal copper panels, alternating in three different surfaces: bright 'mill finish' alongside light and dark brown pre-oxidised copper. Structural columns are similarly enwrapped with alternating finish copper bands and the copper detailing is even continued into elements of bespoke furniture. This internal copper cladding had a post-lacquer finish to arrest further oxidisation, retaining the three colours, protecting the surface and giving a reflective surface.

The same horizontal copper panel composition of three surfaces continues past glazing to the outside. Here, the building's entrance has been transformed with new copper-clad canopies to create a strong, easily recognised identity. Externally, the copper has not received a lacquer finish, as its architects explain: "We consider copper's natural surface development outside, reflecting the local environment, to be one of the material's key attributes. An attractive, gradual weathering and softening of the differentiation between the three different copper surfaces on the canopies has already begun – and will continue over time – as we anticipated."

An alternative approach is to consider today's wide range of copper surfaces and alloys, material forms and installation systems separately for external or interior applications. And the latest developments in abraded and embossed mechanical surface treatments are particularly

Copper and its alloys already enjoy a long heritage inside buildings, contributing a distinctive tactility to door furniture and handrails, and visual richness to lighting and other fittings

suited to interior design, adding another level of 'close-up' visual richness, texture and tactility.

This is demonstrated in the redesign and remodelling of a legendary 1980s spa hotel overlooking Lake Lucerne. Externally, it is clad in vertically arranged brass cassettes creating a flat surface, interspersed with generous glazing. Over time, the brass will weather naturally to complement the brown copper facades of the original building. But copper also forms an integral part of the interior design, particularly in the hotel's grand entrance which welcomes guests with a blend of natural, warm and soft tones. Here, walls and columns are surfaced in continuous copper with a brushed, semi-matt finish. Different copper surfaces are used to highlight fireplaces in individual suites, creating a feeling of richness and warmth.

To fully realise the potential of copper and its alloys – both as architectural and interior surfacing materials – designers need to understand their differing characteristics. The dedicated expertise of copper suppliers will prove to be essential.

Chris Hodson is a member of RIBA and consultant to Aurubis

COMMENT

EPDs: Helping to build the sustainable buildings of the future

Barry Rust of Tata Steel discusses the role of Environmental Product Declarations as a weapon for tackling the obstacles the industry faces in ensuring a truly sustainable, transparent and responsible supply chain

With improved awareness and constant news coverage on the effects that the human race is having on the environment, society is increasingly questioning the impact industry is having on the world. With the UK Green Building Council estimating that the built environment generates a shocking 40 per cent of the UK's total carbon footprint, it's no surprise that our sector is of particular concern.

Determining the environmental impact of a construction project is a complex task, particularly if one is to take a holistic view from cradle to cradle, or indeed cradle to grave. Because of this, Environmental Product Declarations (EPDs) are becoming an important validation tool within the construction industry; developed by manufacturers to provide transparent data about the environmental impact of their products and to enable specifiers to make informed purchasing decisions, assisting their client in constructing a truly sustainable building.

Essentially, an EPD is a document that contains life-cycle inventory data to provide a transparent overview of a product's impact on the environment. This Life Cycle Assessment (LCA) can take into account everything from the extraction of raw

TRANSPARENT
EPDs provide transparent data about the environmental impact of products, helping enable specifiers to make informed decisions in creating sustainable buildings

CRADLE TO CRADLE
Steel is the only truly cradle-to-cradle recycled material

materials and manufacturing process to distribution, the product's use and even its end-of-life value, such as whether it can be recycled or reused.

Generally speaking, there are two main types of EPDs: those that provide average data for a general product category, with information taken from a group of different manufacturers; and product specific EPDs, which, as the name suggests, are individual to a particular manufacturer's product.

Recently, we have begun to see an increased demand, mostly from the top of the supply chain, for specific product data, rather than the generic alternative. This demand could be due to a variety of reasons. The first is related to green building certification schemes, such as BREEAM or LEED. Attaining such a certification can lead to positive results for both the building developer and owner, with BREEAM and LEED-rated buildings often having an increased market and rental value, in addition to the building's operating and maintenance costs being reduced. Specifying sustainable building products with a product specific EPD can contribute numerous credits towards attaining such certification, more so than a generic EPD for a product category.

Another potential reason for the rise in demand is that we are increasingly seeing building developers and architects acquiring a 'genuine' interest in furthering their understanding of transparent and sustainable construction and a desire to reduce the environmental impact of their buildings, which product specific EPDs can help them to achieve.

However, as great as the creation of a truly sustainable, responsible and transparent supply chain sounds, it doesn't come without its fair share of obstacles, with the main challenge trying to ensure that this dedicated approach is the same across the board, present from the very top to the very bottom of the supply chain. Unless a commitment to sustainability is matched across the board, a project will inevitably bow to cost pressures. A tendency to cost-engineer and alter the original product specification still too often leads to the initial best intentions being lost – and cheaper, less sustainable products finding their way onto the specification.

Determining the environmental impact of a construction project is a complex task, particularly if one is to take a holistic view from cradle to cradle, or indeed cradle to grave

At Tata Steel, we are dedicated to delivering accurate and transparent environmental data for our range of products and have also recently become an environmental product declaration programme operator, meaning that we can now provide our customers with both supply chain and product specific EPDs. However, the reality is that if we as an industry are not achieving transparency throughout the 'entire' supply chain, then sadly we won't achieve the improvement in performance we require. Ultimately, if you don't measure it then you can't manage it – the 'it' being a building's environmental impact.

So, what is the solution and how can architects help in implementing it? Architects are in the ideal position to educate and inspire clients to see the long-term benefits of investing in sustainable materials and play a key part in shifting the emphasis away from short-term costings, to responsible specification and whole life value. In turn, if there was increased demand for transparent, responsible and sustainable sourcing of products, then this would likely impact upon the manufacturing community, potentially encouraging more manufacturers to supply their own product specific EPDs, improving the reliability and accuracy of data.

All too often, a developer or client may have every intention of creating a sustainable building with a transparent and responsible construction process. Yet, as the build progresses, each part of the supply chain may slightly alter the architect's original specification, whether in an attempt to reduce costs or due to personal choice. We therefore also need to start seeing more robust specifications from the top to the bottom of the supply chain, with product specific EPDs and sustainability requirements 'built-in' to the specification criteria that cannot be deviated from. After all, if developers and investors want sustainable buildings, then they and their chosen design team need to ensure that those requirements drill down to the very bottom of the supply chain and are not diluted as part of the build process.

Product-specific EPDs are set to play a vital role in improving the transparency and sustainability of construction, allowing developers to achieve Green Building certification, such as BREEAM or LEED, and, more importantly, lessen the environmental impact of their buildings. However, it is also clear that change is required within the supply chain itself, for if we are to deliver the sustainable buildings of the future, this focus needs to be consistently present and executed throughout, from the architect and specifier to the main- and sub-contractor to the manufacturer.

We all have our own role to play, from us as manufacturers responsibly sourcing materials and improving the accuracy of data by producing product specific EPDs, to architects implementing compulsory sustainability requirements in more robust specifications, and finally, contractors who must ensure they honour these and understand the relevance of EPDs.

Barry Rust is energy & sustainability marketing manager at Tata Steel

Facades Academy

@ The Building Centre, November 2019

This November Kingspan Facades is proud to support **Facades Academy**, a month-long series of events including talks, think tanks, workshops, hacker forums and panel discussions covering many of the important issues facing those working within building envelope design and construction. We begin with a panel discussion on sustainability with guest experts and supported by New London Architecture on 6th November.

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For more information about what's happening and to see the agenda of events taking place in November at the Building Centre.

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BUILDING PROJECTS

ISENBERG SCHOOL OF MANAGEMENT BUSINESS INNOVATION HUB AMHERST, MASSACHUSETTS

Domino effect

An addition to the University of Massachusetts displays a composition of staggered copper and glass elements to create a dramatic entranceway. Jack Wooler spoke to architects BIG about how and why this domino effect was created

The Business Innovation Hub is the latest addition to the University of Massachusetts Amherst, adding around 70,000 ft^2 of "hyper collaborative" study and social space with a 'domino-effect' copper and glass facade.

This extension has been constructed as though it were a large amphitheatre – surrounded by copper pillars that appear to fall on to one another, connected together across the facade by a glass curtain.

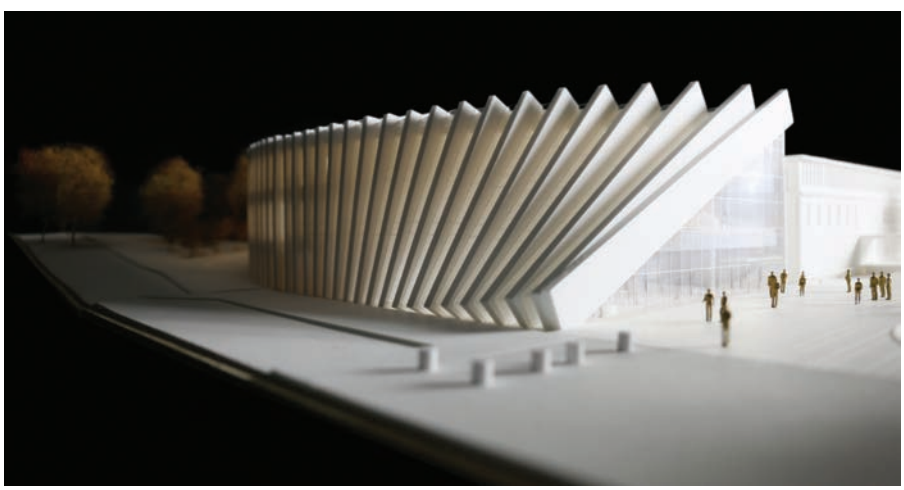
The project, designed by BIG-Bjarke Ingels Group with Goody Clancy, involved the expansion and partial renovation of an existing facility, effectively doubling the school's space in order to accommodate its growth in the last decade.

Among the large and multi-faceted group of collaborating firms on the project were Richmond So Engineers, Arup, Big Ideas, Nitsch, VAV, Towers Golde, Haley & Aldrich, Acentech, HLB, SGH, PEER, WIL-SPEC, VGA, Lerch Bates, LN Consulting and Mohar Designs.

Flexible academic design

UMass Amherst is the main campus of the University of Massachusetts, and as such hosts a wide variety of buildings stretching back to the 1960s. The business school is one of the top 30 in the United States, and its expansion has provided facilities for more than 150 staff and 5,000 students in undergraduate, masters and PhD programmes.

The Isenberg School of Management moved to this site in 1964, initially taking form as a large rectilinear, three-storey



red-brick building – which still stands today. This was later extended on its southern elevation in 2003, and the new addition effectively follows in its footsteps, adding to the building's northern elevation.

Commissioned in 2015, the Business Innovation Hub directly extends this existing building from the north and east sides in a wide circular loop, linking back on the upper floors to maintain connectivity.

In the first instance, BIG and Goody Clancy were given the aim of designing a flexible space that inspired collaboration for all students at Isenberg. Tom Moliterno, interim dean at the school, explores this further: "As a top business school, we want to offer our students, faculty and staff an environment that inspires creativity, communication, innovation, and collaboration—a physical space designed to train and prepare students for careers in the 21st century. The new Business Innovation Hub clearly reflects our mission and vision for the future."

He adds: "Equally important, with flexible spaces and state-of-the-art tools and technologies, the Business Innovation Hub will continue to meet the rapidly evolving needs of the Isenberg community."

Approaching the building

Now completed, the shifting, domino-effect of the new facility's facade can be seen from across the university campus – displaying a somewhat complex structure. Rectangular pillars are progressively angled downwards as if tumbling onto one another, eventually culminating in a triangular entranceway with the final pillar forming one side of this triangle.

This unique exterior is made more expressive through copper cladding – which is laid out in a brick-like fashion – with the intention of the long-term exposure to the elements naturally weathering the metal from a dark ochre to an enduring patina. The copper elements wrap around the sloping facade in such a way that they appear to curve around the building – though in reality they run straight.

Each of these copper modules are 2 ft wide, with the glass curtain being 3.5 ft wide. The copper panels are clipped to aluminium rails, fastened to a sheathing clad cold-formed framing structure produced by Ace Panel Worx.

When approaching this strikingly formed facility in the evening, the building "glows from the life within," appearing as an inviting beacon on the campus. Running

around the site's existing faculty building in a C-shape, it is hoped that the new amphitheatre-style addition will create a lasting impression for visitors, staff and students alike. Extending from the existing Haigis Mall to the Learning Commons, it is intended that the dramatic triangular entrance way will provide a more welcoming invitation to the facility.

Similarly impressive in the daytime, the copious use of glass between the copper sections allows for a significant interaction between the building's exterior and its interior workings, the glazing allowing views extending almost 360 degrees around the building's perimeter.

The looped form of the building – which creates a 'C' shape – together with this entrance, have now effectively consolidated Isenberg's faculty and staff under one roof, creating a singular place of arrival and a strong visual identity for the entire Isenberg School of Management.

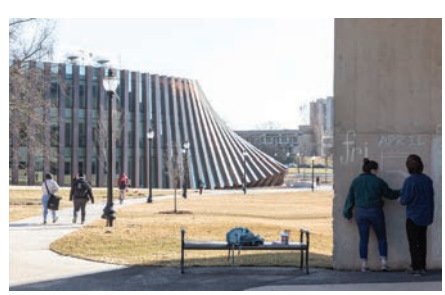
Yu Inamoto, project leader at BIG, explained this further: "The conceptual move to create the building massing and space inside the Isenberg Business Innovation Hub was actually a rather simple one – a loop originating from, and connecting to, the existing building, then stretching one point of that volume to create a multi-storey space."

Going inside

Upon entering, students and faculty arrive inside the 5,000 ft² 'Learning Commons'. Daylight breaks through to this area from in between the accordion-like pillars to illuminate the multi-storey atrium in the centre of the new addition, where the heart of the business school reportedly "hums with students learning, networking and dining." This bright and spacious networking area also doubles as an event venue for guest speakers, award ceremonies, banquets and career fairs.

Across the Business Innovation Hub are several spaces such as this one, designed with student interactions, teamwork and chance encounters in mind. Helping facilitate this are soft chairs dotted along the corridors, benches fixed to the grand

TUMBLING
The copper-clad pillars are arranged at progressively lower and lower angles, the final one forming the building's triangular glazed entrance



The shifting, domino-effect of the new facility can be seen from across the university campus – displaying a complex facade of vertical pillars, which gradually slope downwards as if tumbling onto one another

stairway, and classroom chairs that can be easily manoeuvred for theatre-style lectures or small-group work.

Similarly, throughout the building daylighting has been maximised where possible, such as around the entrance, where natural light penetrates inside from both the campus and the inner courtyard. The levels of daylighting provided by the designers, as well as the building's overall atmosphere, have already seen it gain notable praise, with one user quoted as saying "they want to be in the building all the time".

Walking around this floor, the building's loop form creates the circular internal courtyard, with the linear structure hugging it. Inside this courtyard, the space is intended to provide a forum for the students, faculty and professionals to meet, mingle and "mix society and academia."

This courtyard is surrounded by the internal spaces of the facility on all sides, with copious glazing providing interaction inside and out and daylighting for work. In the courtyard space itself, the architects have designed an open-air garden and stone benches, which are intended to create an "oasis for collaboration and contemplation."

Access has been provided between this open space and the campus via two pathways between the original Isenberg building and the Business Innovation Hub. The project team have not just allocated this for the ground floor, however, with the building being fused by two bridges above those paths. One is a large bridge cloaked in copper, which is intended as the gateway to the courtyard, while the other, the smaller bridge, displays glazing aimed at providing a visual continuity around the building's interior courtyard.

Going back inside and up to the second and third floors, students and staff occupy the innovation labs, 'advising' spaces and faculty offices. To support the career development of every Isenberg student, classrooms have been equipped with integrated technology for distance learning. As well as this, a new function, named the Chase Career Centre, has been provided with 15 new interview rooms, alongside

various conference rooms and breakout areas distributed through the loop.

Community response

The new building has already received widespread praise from the community and its users. This is not just in terms of its functionality, but in its ecology – with longevity and sustainability in mind, the client has targeted LEED Silver certification.

As to its users, about a month after the addition was completed, impromptu interviews were held with the students in order to understand their reaction, and to see if the building was being used as intended. If the interviews are to be relied upon, the project has proved to be an all-round success.

Third-year OIM major Michael Zola, for example, hails the spaciousness of the new facility: "The building's study rooms and open spaces make it a great place to work, hang out, and network."

Alongside the open nature of the building, the success of the design for fostering a sense of collaboration appeared to be a common theme among the respondents: "Its interactivity and visual projections make it an extremely nice learning environment," observes freshman Danielle Major, who's taking her Business Data Analytics course in the Hub's Business and Analytics Lab. "Although Isenberg has gained considerable space, its savvy design makes the school seem socially smaller," she adds.

All in all, it seems as though the addition has breathed new life into the campus, and is providing students with an added motivation to spend out-of-lecture-hours enjoying the new building's extra facilities. "Before the addition, I never had any reason to stay at Isenberg," explains sophomore accounting major Matthew Haggerty. "With the improved atmosphere, I stick around until my homework gets done."

Together with the striking cladding, by a renowned international architectural partnership, this is clearly a success story for the faculty, which provides a very effective new entrance, fitting for one of the US' leading business schools. ■

BUILDING
PROJECTS

VESSEL
NEW YORK CITY

Grand central viewing station

As part of creating a bespoke structure in the centre of a major New York development to offer unique public space, Heatherwick Studio utilised a revolutionary technique to create a copper finish in steel that wouldn't degrade over time, as Roseanne Field reports

The neighbourhood of Chelsea on the west side of Manhattan, New York, is home to a huge new development – Hudson Yards. Dubbed the "cultural centre" of Manhattan's New West Side, the project by real estate companies Related and Oxford Properties Group consists of offices, public art and cultural institutions, a hotel, over 100 shops and restaurants, 14 acres of public space, and four residential towers with apartments for both sale and rent.

What Related felt the development was missing was something at the heart to tie it all together, and so they approached a range of practices to come up with a concept. Heatherwick Studio had the winning submission, and the project moved forward from there in what was a "quite straightforward" process, says project leader at the firm Laurence Dudeney.

The practice more or less had free reign. "It was kind of a great blank slate in a way," Dudeney explains. "They put so much work into this mega development, really historic in terms of its size and quantity and funding, but they knew they needed something to really bind it all together."

The development had been designed "really smartly," he says, to provide a piece of open, public space. He adds: "They were engaging with us on how to activate it and give prominence to the whole development." Originally, the project's landscape architects, Nelson Byrd Waltz, had come up with designs for the plaza but, says Dudeney, "they realised that they needed something more".

Design development

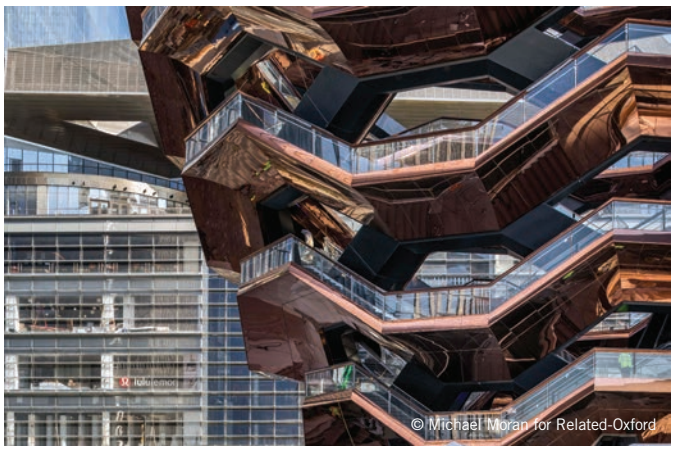
Having been given a relatively open brief, Dudeney and the team's first thought was that whatever they designed needed "a single point of focus" and "to have some ability to hold its own" and therefore draw people to it. "Our main concern was that this development was so big and whatever we put in there would just get lost," he explains.

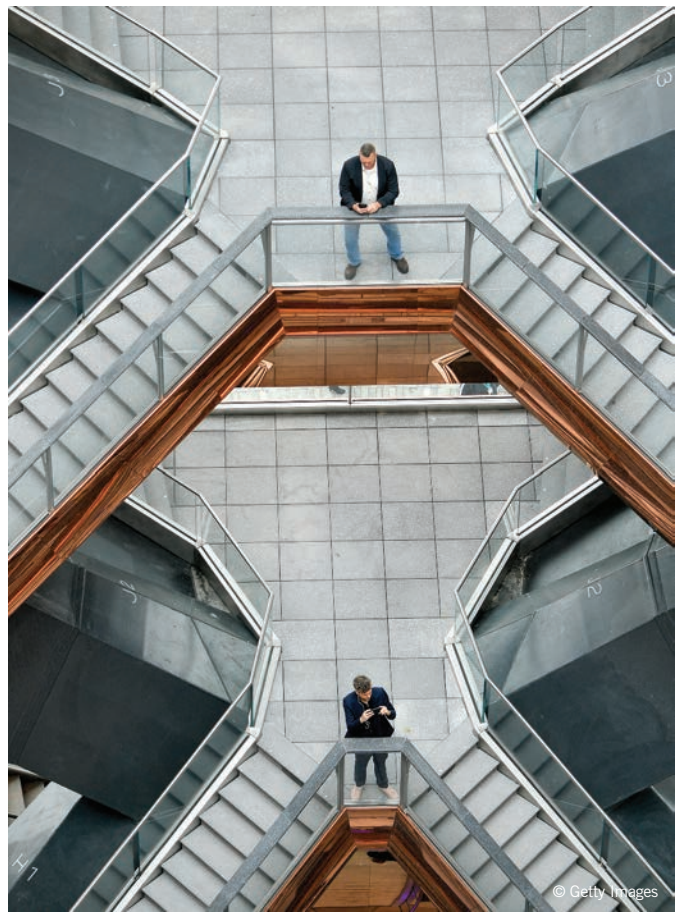
Their original line of thinking was looking at sculptures – "it's not uncommon in New York for a developer to think about putting in a piece of public art," explains Dudeney – but it was an idea they quickly dispelled on the basis people would simply take pictures and walk away. "We wanted something much more engaging and interactive," he says. They looked at various ways of doing this – such as with digital and mechanical interventions – but ultimately agreed it needed to be "more open" and a public space that "you should be able to walk into and experience. It was the idea of allowing people to experience public space from a different dimension," he explains.

They decided to build a tall structure for a couple of key reasons. Firstly, it seemed logical in that it would create more space than what was there already, as opposed to constructing something that would take away that space. It was also for this reason that Vessel takes its unique shape, increasing in width the higher its gets. "Rather than reducing the space left for the city, we wanted to raise it and bring people up," Dudeney explains.

They also wanted to keep the structure in

The material was put through rigorous tests by the studio and contractor Permasteelisa





"It's a phenomenal achievement. It's so New York"

Laurence Dudeney, Heatherwick Studio

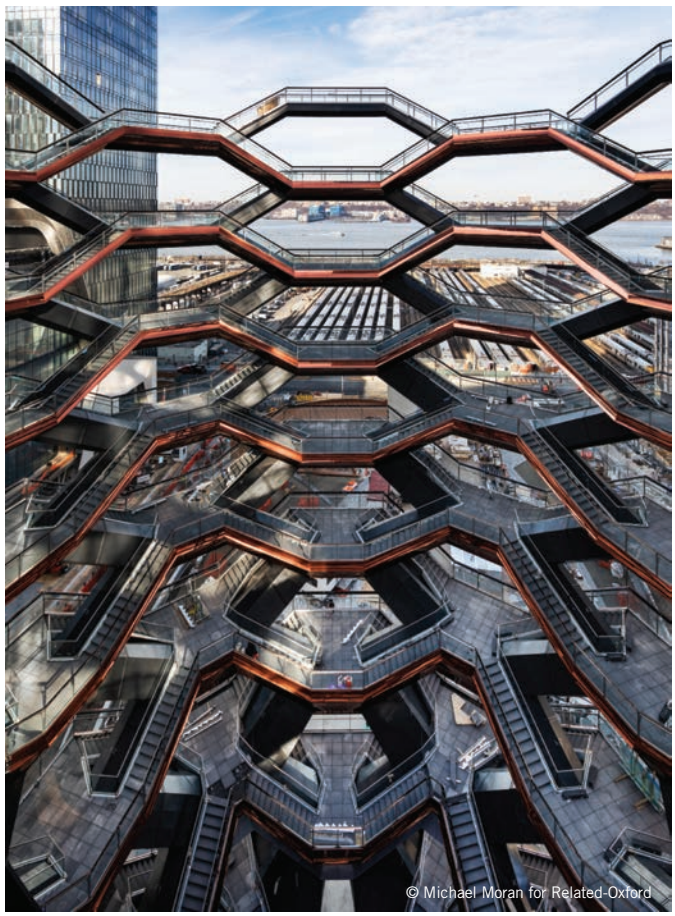
proportion to the heights of the surrounding buildings. "It needed to have a decent scale in order to do it justice," says Dudeney. The site itself, and specifically the High Line – a 1.45 mile-long raised park, 'greenway' and rail line on New York's west side – also influenced their thinking. "It's really energised people and made them think about New York in a different way by making it accessible." The piece of "heavy infrastructure" inspired them to "think about infrastructure as a way of expression".

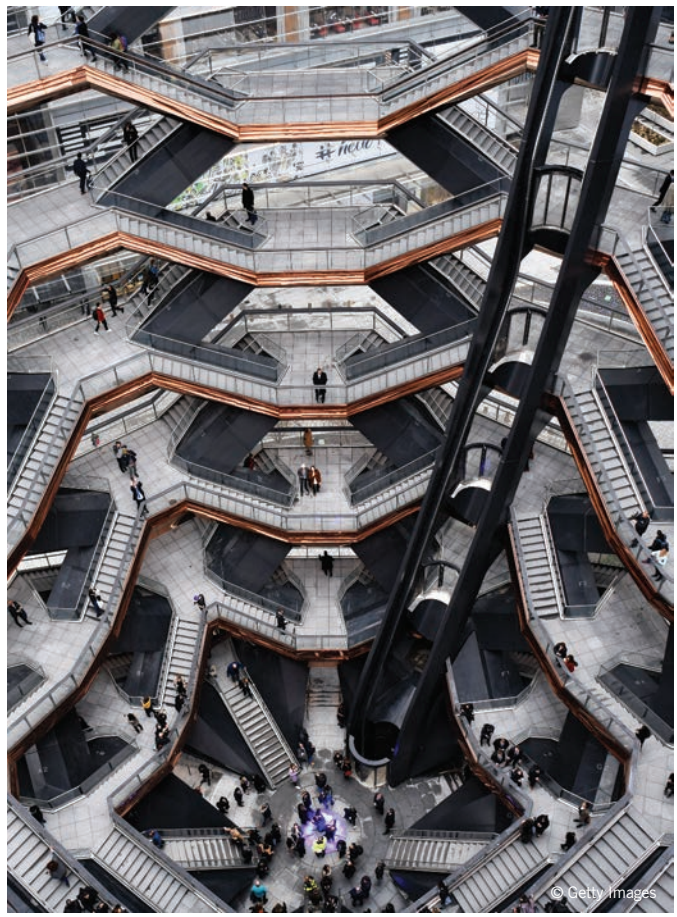
The entire development has been constructed on a platform over working train lines, with trains constantly running underneath, explains Dudeney. "It's a phenomenal achievement. It's so New York, it's just another layer," he says. "That kind of American 'look forward' mentality, we were excited by how infrastructure could play a part in this."

Coming up with the unusual shape wasn't something that took the team too long. "This was an almost immediate understanding," explains Dudeney. They had spent time researching public spaces around the world, particularly in Europe, and realised that areas with a change in level – such as the Spanish Steps in Rome – were a "phenomenal magnet for people to come and hang out."

They began exploring the idea of using steps and "went on this exploration of stairs and historic infrastructural uses of them". At this point they came across the Indian Stepwells, the geometry of which became the direct inspiration for Vessel's design. "We were thinking about how the geometry would play and fit," says Dudeney. "But the idea always remained the same." The resulting self-supporting structure, which has no columns or beams, is a series of pairs of staircases (154 flights in total), between each of which is inserted a steel spine.

The building's porous structure was designed as such so people could look out of it, as well as in. "We never saw this as an indoor experience, it felt wrong to enclose it," Dudeney explains. "It was something that generated purely from thinking of the experience of how people would navigate it and what do they see."





The client was always in support of their ideas. "We realise that projects are great when we have a great relationship with the client," he says. "They were really engaging and involved throughout the whole process."

A lasting finish

The studio knew they wanted to clad Vessel with something "warm and inviting" to offset the fact that the majority of Hudson Yards' towers are glass. "We wanted something to counteract that and act as a draw," Dudeney says. They first looked at copper but were put off by the weathering and changes it would undergo, and the consequent maintenance required. "We designed Vessel to stand for generations," he explains.

Despite disregarding copper itself, the studio still wanted to achieve the same finish, so began exploring alternative options. They looked at electroplating but weren't convinced, as it "isn't always super stable". They then came across a process called physical vapour deposition (PVD), where sheets of stainless steel are placed into a vacuum chamber and exposed to nitric oxide. The gas reacts with the surface of the steel, creating a chemical bond and producing the copper colour Heatherwick were after.

It's a process that has commonly been used on a much smaller scale – such as iPhones and pens, explains Dudeney – but is now being utilised on a much larger scale. "The reason we really got drawn to it is its longevity. You don't need to maintain it – the colour will look exactly the same in 90 years."

The material was put through rigorous tests by the studio and contractor Permasteelisa, to see how the surface would react once it had been formed and shaped into the required parts to fit the curved soffit. "We realised once the sheets were coloured they would need to be bent into shape, and we needed to find out what that would do to the surface and the visual outcome of it," Dudeney explains. The only altering was on the "tightest radius bends" where "you get a slight stretching in the colour but it's very minute," he says. "Otherwise it stands up very well to being

PVD
Physical vapour deposition (PVD) was used for the material – where sheets of stainless steel are placed into a vacuum chamber and exposed to nitric oxide

STEEL
In total there are 75 major steel components – which were built at Cimolai's yard in Italy

PROJECT FACTFILE

Designers: Heatherwick Studio
Client: Related / Oxford Properties Group
Design engineers: AKTII
Structural engineers: Thornton Tomasetti
Landscape architects: Nelson Byrd Woltz
Architect of record: KPF Associates
Steel contractor: Cimolai
Lift contractor: Cimolai Technologies
Cladding contractor: Permasteelisa
Crowd analysis: Arup
Lighting designers: L'Observatoire International
Project management: Tisham

manipulated like that." It was also unaffected by being cut where necessary. "There was a huge quality assurance over the whole project and we're really happy with it," Dudeney says.

As well as being tested for the specific ways it would be manipulated for Vessel, it also underwent testing that put it up against the saline atmospheric conditions of New York. The practice have been so impressed by PVD they're likely to use it again, says Dudeney. "As a studio we are very interested in materials," he explains. "We're always interested in designing through exploration of materials so this is another way for us to expand our knowledge."

They chose not to clad the entirety of the soffit in the copper-look steel – it mostly runs along the underside of each walkway – leaving certain elements of the painted carbon steel structure on show. "New York has a great steel heritage so we were keen to show off the joints and what the structure is," Dudeney explains. In total there are 75 major steel components – which were built at Cimolai's yard in Italy. The stainless steel upstand was also added before the components were shipped to site and assembled along with the concrete flooring and glass balustrading. "What they managed to do was fantastic," says Dudeney. Each splice joint location was influenced by the practicalities of transporting the steel elements and where they needed to be broken up but, he says, "I think it makes the whole thing feel more relatable and interesting."

Everyone working on the project was focused on tackling the constraints of a busy Manhattan site – surrounded by tower block construction – and every precaution was taken to minimise the work needed insitu. Cimolai test constructed the bottom few levels in Italy, and the Heatherwick team would fly out to look at it, check the tolerances and make any necessary changes before the components made their way to the US. "That whole process really helped debug anything that might have happened in New York which was great," says Dudeney. "Logistically there was a lot of work in terms of getting materials in and out and they did a great job with that."

Engineering challenges

One of the "major challenges", says Dudeney, was figuring out just how small they could make Vessel's base, and how large it could be at the top. "It's the complete reverse of what buildings normally do, for very good reasons!" he says. "You mix in New York regulations, the physical reality of what carbon steel can do and the structural limitations, and the

Dudeney describes the process as "more like designing a bridge in terms of how it's been put together and the materials that have been used"

physical movement and how much it needs to hold – lots of different things over the course of its design affected what you see now."

Dudeney describes the process as "more like designing a bridge in terms of how it's been put together and the materials that were used." They faced the "classic" issue of how to balance the components so it would provide the necessary stiffness but not be big and bulky. Their work with engineers AKTII and Thornton Tomasetti was "paramount" in making the structure work. "They did lots of dynamic analysis on it, we had tuned mass dampers all along the top which helped calibrate the whole structure's movement," he says. Software was also used to model how people would use it.

Surprisingly, the base was another of the most complicated parts. "Once you get up the top the platforms are large, there's more space – the base is the most constrained element," Dudeney says. There are four sets of stairs and the lift is squeezed into "the smallest gaps you could possibly have." The varying angles also proved a challenge, with every steel and concrete connection having to be thought through individually.

While these elements presented challenges, Dudeney found the biggest trial to be the lift, an element that the studio were mainly responsible for. "It is an absolute feat of engineering," he says. The shape of Vessel meant it had to move on a curve. He explains its unprecedented nature: "To those of us who don't design lifts, it seems it should be possible, but actually it's not out there." The final product was custom-engineered and custom-built by Comai Technologies, and is "one of the more unique experiences on the Vessel".

Mixed reactions

Since Vessel – which is free to explore – was completed in March, it's been subjected to some fairly harsh online criticism online. But it isn't something Dudeney and the team are particularly phased by: "Any project will have negative feedback, and

© Michael Moran for Related-Oxford

that's just the nature of it," he says. "It's one of the amazing things about this industry, you're not working towards an echo chamber – you have all of New York and there's divided opinions. We're always ready and prepared for that."

Their focus, he says, was very much on creating a public space for people to enjoy – something they've undeniably achieved. Nearly one million people have visited since its completion and "that's people going inside, not walking past and taking a photo," Dudeney explains. "For us that's amazing. We always have to work on that broader spectrum." ■

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Extending design perspectives with aluminium

Richard Besant of Powdertech Corby discusses why powder coating on aluminium presents a convincing alternative for creating a wide variety of architectural features and designs

Recent advances in powder technology and application now mean that aluminium and steel can be powder coated as a credible alternative to natural elements such as stone, wood, terracotta, copper and bronze, and to the processes of anodising and Corten steel.

Sustainability

Finding a combination that will bring life to a piece of metal, making people admire it, touch it, and wonder whether it is 'real' wood or stone or bronze, is a delight for any architect or designer. Using aluminium, or steel in preference to scarcer materials is paramount in an era fully aware of the need to protect natural resources.

It makes perfect sense to use aluminium for as many construction purposes as possible, including those regarded as decorative, which is where wood, stone, coppers and bronzes have often been the materials of choice. In most cases it is the appearance of these materials that is desired, rather than their inherent properties, and powder coatings can satisfy that aesthetic requirement.

Light weight, strong and recyclable, aluminium can easily be made to resemble these earthy natural elements. Aluminium is the most abundant metal in the Earth's crust and iron follows closely behind with steel being an alloy of iron, carbon and other elements. Both metals are highly recyclable, with 75 per cent of aluminium in use today being recycled.

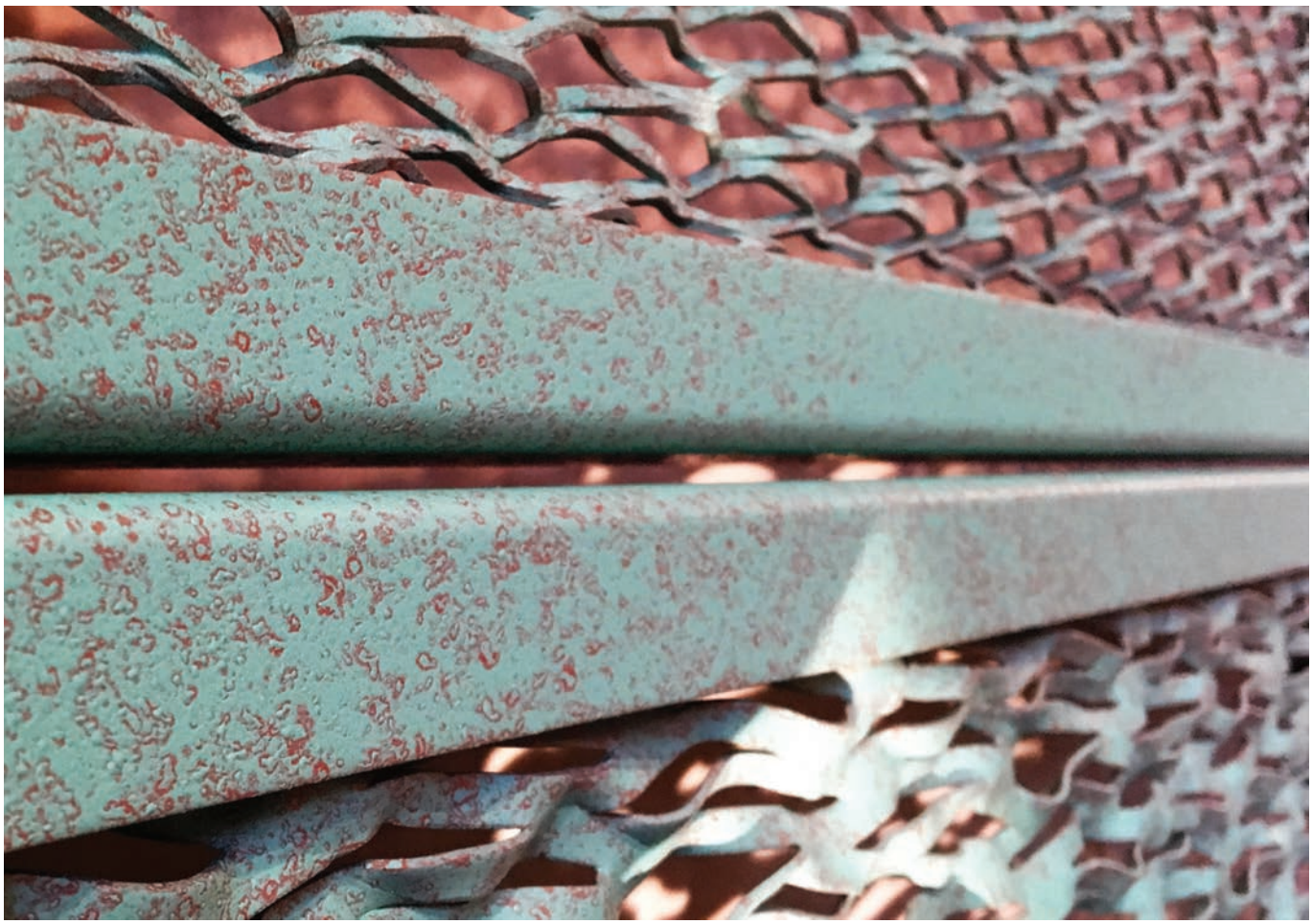
Powder coating has no effect on the recyclability of aluminium or steel. It has clear environmental advantages over wet paints by being a dry powder, with no solvent, and therefore emitting no volatile organic compounds (VOCs). Powders contain no halogens or heavy metals and there is no hazardous waste. The coating process is a factory-controlled application-taking place in a sealed booth and excess powder is collected and re-used so waste is minimised. Many powder coatings have a reaction to fire classification of A2, S1-d0, making them suitable for construction.

SCULPTURAL
Patination on bronze, Yorkshire Sculpture Park

An exceptional metal

It is little wonder that aluminium is the 21st century's building material of choice. In addition to its abundance and high level of recyclability, aluminium is extracted, processed and fabricated with a high degree of efficiency.

For architectural features, aluminium has some unequalled advantages over other materials. It is ductile and can therefore be formed into complex shapes and profiles



AGED
Powdertech Evolution 'Aged Copper'

Recent advances in powder technology and application now mean that aluminium and steel can be powder coated as a credible alternative to natural elements such as stone, wood, terracotta, copper and bronze

whether extruded, folded, rolled, cast or machined. The products can be flat, curved, perforated, expanded or sandwiched with other materials.

Aluminium is also lightweight and therefore easy to transport and easy to work with. It has an exceptional strength to weight ratio and can achieve long spans, leading to fewer fittings and faster installation. With excellent intrinsic corrosion resistance, aluminium does not become brittle at low temperatures; in fact it increases in tensile strength.

A clean finish

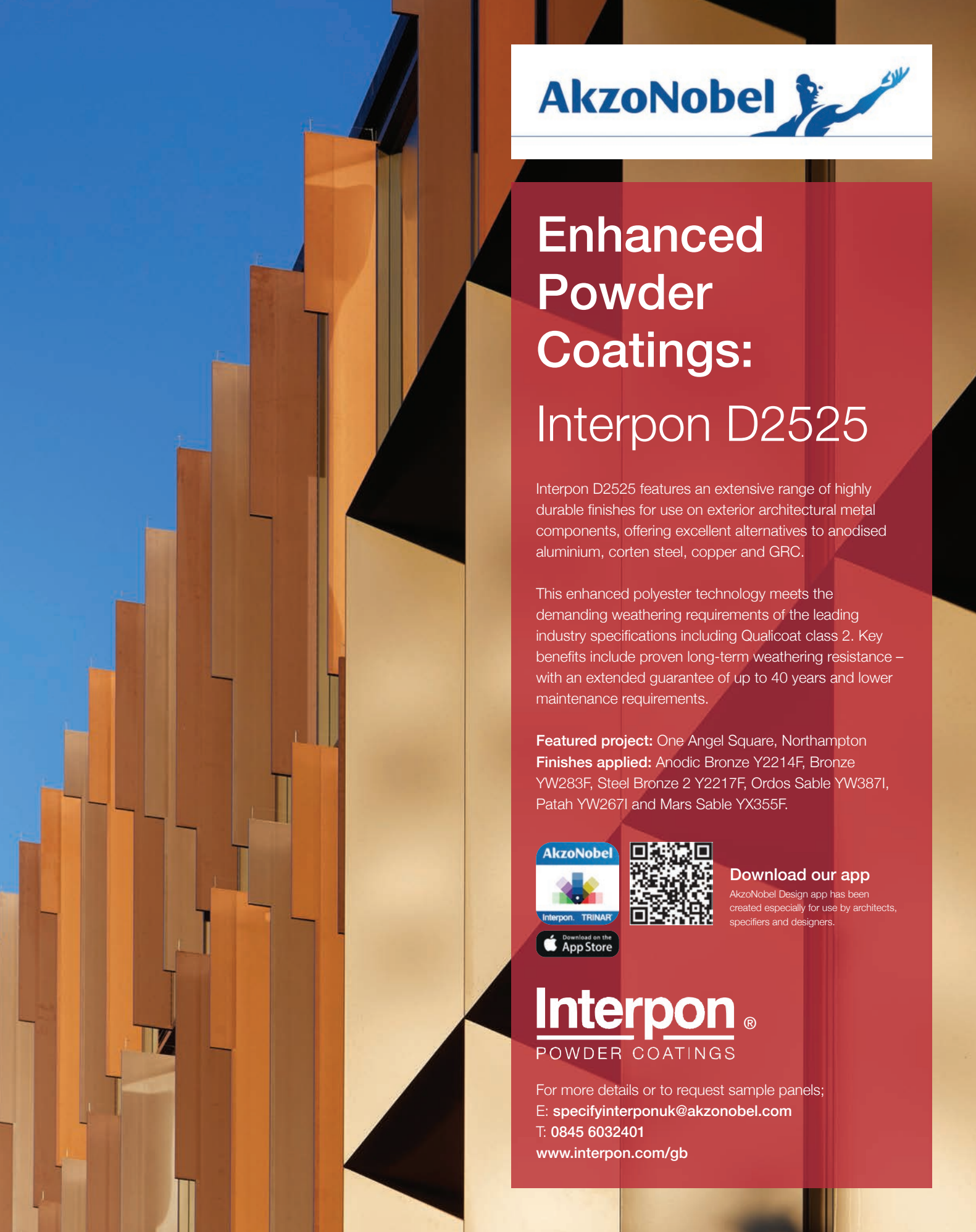
Stone or wood on a building looks attractive when clean, free from lichen, mildew and general staining. These materials need a rigorous maintenance routine to keep them looking at their best. Powder coatings, on the other hand, need minimal maintenance – a quick wash over with water and a basic detergent will remove and prevent staining. The natural appearance of rusted steel has been popularised by the product Corten, but the rusty surface still leeches colour and can stain surrounding materials. A powder coating emulating rusted steel will not leech colour.

Reflecting nature

Consistency within powder batches is a known benefit of powder coating especially for modular builds, allowing the colour to be consistent across the development. Where variation in shade and tone is needed, reflecting that found in natural materials, powder coating again meets this need to give a 'consistent inconsistency', achieving a realistic overall impression of homogeneousness.

Powder coatings can impart many different appearances to aluminium, allowing architects and designers to introduce the appearance of stunning, natural materials into their projects without using less manageable materials.

Richard Besant is sales director at Powdertech Corby



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Sustainable and diverse: architectural copper

The last few decades have seen copper and its alloys grow in popularity as modern architectural materials, but the sustainability and performance characteristics of copper should also not be forgotten. Graeme Bell of Aurubis explains more

Copper's unique architectural qualities are defined by its naturally developing patina, determined by the local environment, which cannot be replicated successfully by other materials using applied coatings. Weathering over time gives a darkening surface colour to copper that can eventually result in the distinctive green or blue patinas seen on older roofs.

Living surfaces

To provide – straightaway – the brown oxidisation or blue/green patination of copper surfaces, factory-applied surface treatments are popular, particularly for facades where rainwater 'dwell-time' is insufficient. These processes can enable designers to determine both the colour and intensity of patina for each project from the start. As well as a solid patina colour, other intensities can be created revealing some of the dark oxidised background material as 'living' surfaces.

Some of the processes involved are very similar to those taking place in the environment and utilise copper mineral compounds, not alien chemical actions. They bring forward the environmental changes without taking away the integrity

HONEYCOMB
Extremely flat, pre-oxidised copper honeycomb panels clad The Catalyst building at Edge Hill University, Ormskirk by ABW Architects © Infinite 3D

ROYAL ACADEMY
Traditional seam-jointed, pre-patinated copper cladding envelopes additions to the Royal Academy of Music, London by Ian Ritchie Architects
© Adam Scott

With a melting point of 1083˚C and 'A1 (non-combustible material)' fire classification to EN 13501-1, copper is suitable for cladding tall buildings using appropriate constructions

of copper as a natural, living material. They form an integral part of the copper and are not coatings or paint, and on-going changes will continue over time depending on the local environment.

Alloys of copper have also grown in popularity with architects. They include bronze, an alloy of copper and tin, which gradually changes to a dark chocolate brown, and brass, which can also be supplied pre-weathered. An innovative alloy of copper with aluminium and zinc, it enjoys a rich, golden through-colour, which remains very stable, just developing a matt surface – but no patination – over time. Most recently, these surfaces and alloys have been made available with a diversity of mechanically applied surface treatments, particularly suited to interior design applications.

Apart from traditionally jointed, rolled material supported by a substrate, various other forms of copper are increasingly being explored by designers. For example, copper can be supplied in profiled sheets or extremely flat honeycomb panels, pressed to provide surface textures and modulation, or perforated, expanded or woven as mesh for transparency.

Sustainable performance

But there is more to architectural copper than meets the eye, particularly in terms of recyclability, sustainability and long-term performance. Copper architectural products are produced in modern plants with strictly monitored environmental performance and well-established recycling routes. They include high levels of recycled materials – typically 85 per cent or more with scope up to 100 per cent, saving on energy and greenhouse gases, and contributing to the circular economy. As a lightweight and flexible covering in buildings, structural support demands are reduced, resulting in lower carbon and whole-life costs.

At the end of a building's life, copper retains a high scrap value, which drives recovery and recycling. Copper can be recycled again and again without any loss of performance or qualities. Copper's exceptional longevity is due to the patination process, which ensures extreme durability without maintenance and resistance to corrosion in virtually any atmospheric conditions. The lifespan of copper roofing and cladding can therefore be regarded conservatively as 200 years, subject to substrate and structure, and this is endorsed by experience. Naturally, this longevity has a significant impact upon comparative whole-life cost assessments.

Natural and safe

Copper is a natural element within the earth's crust, which has been incorporated into living organisms throughout the evolutionary process. It is an essential nutrient required by virtually all higher life forms and nature is well adapted to making best use of copper, protecting itself from any negative effects. Copper is safe to use and can be worked at any temperature, without becoming brittle in cold weather or deforming in hot weather. It requires no decoration, maintenance or cleaning, saving resources, cleaning chemicals and cost. Its interaction with the environment has been assessed under the European Reach chemical policy, and has no classification/restriction.

With a melting point of 1083˚C and 'A1 (non-combustible material)' fire classification to EN 13501-1, copper is also suitable for cladding tall buildings, using appropriate constructions. Low thermal movement makes it straightforward to use in any climates and locations. It is also non-toxic and safe to handle, as well as non-brittle and predictable to work. Copper's inherent antimicrobial qualities make it ideal for touch surfaces internally as well.

Graeme Bell is sales and marketing manager at Aurubis

The enduring appeal of metal ceilings

Here Peter Symons of Knauf AMF explores why metal ceilings are seeing a renaissance, encompassing robustness and efficiency as well as aesthetics

The mainstream use of metal ceilings originated in the late 19th century when they were more commonly known as 'tin ceilings' and were promoted as being a durable, 'handsome', fireproof, economical and quicker to install alternative to decorative plaster.

Great technological strides have been made in the intervening century, with significant growth over the past 30 years in the specification of highly engineered, precision metal ceilings. Numerous factors have contributed to this success.

A long-term investment

Metal ceilings represent a wise long-term investment. They are easy to install, exhibit superior dimensional stability, and can withstand rigorous handling. Metal ceilings are also virtually maintenance-free, less prone to damage and are largely impervious to environmental conditions, with a very long lifecycle of up to and over 40 years.

The ceiling void of most new and refurbished buildings now need to accommodate increased technical requirements and are home to complex services including electric, light, heat, telecoms, air conditioning etc., which need regular maintenance and repair. Having a robust, non-combustible, easily demountable ceiling system, which allows ease of access without fear of damage, is an increasingly important consideration for specifiers.

In addition, the perforated surface incorporated into the design of many metal ceilings can also work well with integrated sprinkler systems and more successfully withstand accidental water damage.

Design

Metal ceilings are popular amongst specifiers as they represent a highly versatile and appealing material, which offers real design freedom, particularly where visual impact is desired. They are available in a wide variety of dimensions, shapes, patterns, finishes and colours, which can enhance any interior. The finished result offers a crisp, appearance, which can convey a strong sense of style, quality, modernity and even opulence.

Typically, metal ceilings have been used within prestigious corporate headquarters, offices and banks as well as airports and

other transport termini where high traffic and intensive use called for the most resilient materials. More and more, designers are recognising the benefits of metal ceilings for use within leisure, educational and retail environments as well as restaurants and hotels.

Sustainability

Metal ceilings appeal to those looking for green products as they embody good environmental and sustainability credentials. Steel is the most recycled material in the world, with 94 per cent of steel used in UK construction being recovered. Many aluminium ceilings contain up to 98 per cent recycled content and require only 5 per cent of the energy used to make primary aluminium during the recycling process. These highly sustainable materials can be 100 per cent recycled and re-used repeatedly without degradation of quality.

Hygiene

For surfaces to be deemed clinically clean, they must have the ability to be wet washed. Metal ceilings provide a tough, highly resilient surface, which enables easy cleaning, inhibiting the build-up of dirt and preventing odour absorption. They are also impervious to a wide range of cleaning agents and regimes, mitigating the risk of damage or degradation.

Humidity & Acoustics

Metal ceilings can also offer high humidity resistance. With the correct anti-corrosive protections and coatings, metal ceilings can be used externally or in wet areas, designed to offer no danger of warping or sagging.

It might seem counter-intuitive to consider a metal ceiling when looking for good sound absorption and acoustic control. But modern metal ceilings are so flexible in terms of their design that they can offer excellent acoustic performance levels. Tiles can be specified with a variety of perforations and infills behind the ceiling facade to meet specific sound absorption (up to Class A to EN ISO 11654), combined with high levels of sound attenuation.

Light

Metal ceilings can also contribute significantly to optimising light reflection, depending on the colour, gloss level and size of the perforation, enhancing the ambience of the space and contributing to reduced power costs.

In summary, metal ceilings are enjoying a renaissance and it's easy to understand why. Aside from their versatility and ability to add a 'wow' factor to any interior, they are virtually maintenance free, have a very long product life and are largely insensitive to environmental conditions. Demounting for maintenance is quick and easy, they enable problem-free cleaning and are excellent for use in areas with specific technical requirements due to the variety of coatings and installation options available.

Peter Symons is commercial director at Knauf AMF

A strong & secure story

Whether it's building bridges or delivering homes, there's plenty of scope for structural steel across the construction sector. Chris Holleron of Hadley Group details the material's uses, from its invention to its current application in the offsite construction sector

The history of structural steel is long and storied. For many, the tale begins with Sir Henry Bessemer, who first developed the 'Bessemer process', a manufacturing approach that allowed high-quality steel to be produced economically enough for use in the construction sector. Prior to this, steel had been ignored by architects, who instead opted to use wrought and cast iron until the very late 19th century.

The 'Bessemer process', however, changed all of this and allowed a number of industries, which were previously constrained by the lack of steel, to expand. Noticing the immense potential of the technology, Sir Henry Bessemer moved his operation to Sheffield and set up the nation's first steelworks plant. In doing so, not only did he shape the face of a city, but also he changed the way we would go on to build the world around us.

One of the first industries to benefit from a greater availability of steel was the bridge-building sector. The Brooklyn Bridge in New York was the first bridge to extensively use steel throughout its design. At the time of its construction, it was the

Massive steel frame structures like the Centre Pompidou in Paris and Waterloo International Station in London showcased what could now be achieved with steel

longest suspension bridge in the world. Other structures, like the Forth Bridge were also fabricated from steel and completed before the turn of the century.

By the start of the 20th century, structural steel had become far more common in the construction, especially in America. It was used to build a number of high-rise commercial structures in Chicago and New York. The trend then followed into Europe and in 1904, the Ritz Hotel, Britain's first fully load-bearing steel-frame structure, opened in London. However, it is argued that the most famous steel structure from this period was the Selfridges store on Oxford Street.

The Selfridges project was one of the first projects to showcase the benefits of using structural steel to expedite building times. In a rush to open the store, the building's owner, Harry Gordon Selfridge needed a quick turnaround. What's more, he wanted his store to feature an open interior and extensive external glazing. Steel-frame construction was the obvious solution, however because the approach was still so new, the project's engineer had to first agree appropriate building regulations with London County Council. Thankfully, everything had been approved and the store proceeded to open in 1909.

Over the following century, structural steel was used to create more of the world's most iconic towers, buildings and bridges. Most notably, in 1930, around 50,000 tons of steel was used to form the structure of the 85-storey, 378 metre-high Empire State Building in New York. Once again, the comparative time-saving efficiencies of using structural steel were a huge benefit for developers and the structure was erected in just six months. Unfortunately, as this era became dominated by war, price volatility in the steel market increased and the material became more rationed. As a result, structural steel became much less popular within the construction industry. What's more, organisations which did plan on utilising structural steel, had to do so more resourcefully. Many were successful in doing so, a great example being Smithdon School in Norfolk, which was built in the 1950s. The building was constructed using steel frame section, but unlike previous designs, the beams and stanchions were exposed both internally and externally. Not only did it make the building standout, it reduced the need for expansion joints thus reducing the overall amount of steel needed to complete the build.

With price volatility calming, structural steel once again became more commonly used for construction projects. Massive steel frame structures like the Centre Pompidou in Paris and Waterloo International Station in London showcased what could now be achieved with steel. More possibilities opened up as suppliers made technical advances in the production process, including the advent of cold-rolled steel, which allowed suppliers to make traditional steel profiles far stronger.

Nowadays, manufacturers like Hadley Group can supply units using advanced cold-rollforming processes. The internationally patented process can produce light-gauge steel frame sections, which are four times stronger than traditional steel. As the units are so light, they can be manufactured offsite before being delivered and installed onsite far quicker than traditional approaches. It's helping architects and housebuilders to create buildings more efficiently than what could have been achieved previously.

For the past 100 years, steel has given tangible benefits to architects looking to create strong, secure buildings. As a result, steel was in many ways the material that defined the last century. However, thanks to technical advancements, the material now has more practical use than ever before. Who knows – the next century might be defined more by the use of structural steel than the one that preceded it.

Chris Holleron is group product manager – Housing at Hadley Group

Zinc's lasting sustainable appeal

Jonathan Lowy of VMZinc looks at the lasting appeal of zinc as a sustainable solution for the building envelope, as shown on projects from the 19th century to the present day

The Parisienne rooftops adorning Hausmann's famous 19th century buildings helped to define a cityscape that attracts millions of tourists every year. What these buildings have in common is their relative uniformity of materials and designs, which in the case of the roofing, is the use of rolled zinc.

Hausmann's Paris rebuilding programme was the catalyst for the widespread application of zinc and more than 150 years later, this non-toxic, easy to recycle metal is used extensively for standing seam roofs, in particular, in all kinds of contemporary and traditional architecture. As a material that was originally favoured for its durability, workability and aesthetics, it is the additional sustainability dimension to zinc which today offers significant additional appeal in an era when clients and developers are increasingly seeking the most sustainable material choices for their buildings.

Zinc's appeal for roofing and cladding is driven by its material characteristics – 'self-protecting' through its own patina, which develops over time through exposure to the air and water, with long lasting aesthetic appeal. It is also maintenance-free, requiring only rainwater to retain its appearance – no chemicals or special treatments.

Sustainable & safe

As an easy-to-recycle product providing an in-situ lifespan of up to 100 years, zinc's environmental credentials compare very favourably. It is estimated that over 90 per cent of post-use zinc is collected and recycled to manufacture new products, helping to minimise resource use.

Further sustainability credibility comes through the Environmental Product Declarations (EPDs) available for zinc products provided by the BRE and conforming to EN15804, which further demonstrates that the life cycle, manufacture and processing of zinc products have minimal impact on the environment.

The fact that zinc cladding and roofing requires no maintenance during its long service life also helps to minimise its carbon footprint. This 'fit and forget' quality is valid for any application where rainwater is present, with the exception of soffits on some buildings located in coastal areas.

In addition, metals are by definition non-combustible, which makes them a fire safe choice for the building envelope, providing that the surrounding structure, insulation and attachment method matches its performance characteristics, and zinc is no exception. Zinc roofing and cladding products are available as either A1 or A2 classified for non-combustibility, without any special requirements. Zinc cladding or roofing can be fixed to a galvanised steel deck, with the correct insulation specified – basic steps that will maintain fire performance should the worst happen.

Unrestrained geometric freedom

While zinc is widely used for standing seam roofs, this is only part of its story in architecture. This versatile material has been applied to numerous other external envelope elements since it first found its niche in 1830s Paris. It was around that time that production ramped up with new factories capable of meeting a growing roofing demand and innovation thrived with the development of a broader range of zinc products. Today these include cladding, rainwater systems, and interior and ornamental applications.

As a malleable material that lends itself to different forms with ease, zinc's ability to be shaped gives it enormous potential for delivering striking, contemporary architecture. Whether it is a curved facade or an angular structure with multiple facets, a combination of zinc cladding and roofing systems, plus ornamental elements, enables consistency in form, function and performance.

Despite the changing architectural trends and constant innovation in building materials, zinc has stood the test of time, and it is now fundamental in contemporary architecture

Aesthetics and creativity can flourish through the range of surface finishes developed over the past four decades, including engraved zinc. Delivering timeless architecture, however, requires flexibility, which is what makes zinc ideal for unrestrained facade aesthetics. The material can be made to bespoke requirements, through embossing and perforation, with project-specific finishes also an option. While pre-weathered zinc is used most widely, natural zinc is still used where a design calls for a more organic and uneven appearance before the patina forms.

As well as more traditional roofing systems such as standing seam and batten cap, facades give designers more creative scope including rainscreen systems such as interlocking panels, with concealed fastening for clean sightlines and a neat finish. The refined and subtle finish of zinc on the external skin is part of a complete wall build up incorporating acoustic and thermal insulation to meet specific project values.

All round performer

Despite the changing architectural trends and constant innovation in building materials, zinc has stood the test of time and it is now a fundamental in contemporary architecture. From the elegance of central Paris to the edgy architecture of Melbourne, to projects in Texas and the Scottish Highlands, this versatile, sustainable material continues to play a key part in delivering outstanding buildings and enabling aesthetic creativity to flourish.

Jonathan Lowy is operational marketing manager at VMZinc

Here's How Floor Edge Finishing Profiles Solve Common Problems

In the design of a tile or stone installation, there are a number of different finishing situations that can present themselves. Here, Schlüter-Systems highlights just a few of the frequently encountered problems its extensive range of floor profile options can solve.

Problem: Finishing tile against floor coverings of the same height
Solution: Schlüter-SCHIENE
SCHIENE, the original finishing threshold strip, neatly finishes tile and stone coverings against adjacent floor coverings of the same height as well as protecting their outer edges.

Problem: Finishing tile against floor coverings of a different height
Solution: Schlüter-RENO
RENO profiles create a smooth transition between adjoining floor coverings of different heights, and thus feature small slopes (some fixed and some variable).

Problem: Creating durable and slip-resistant stair nosing
Solution: Schlüter-TREP
The edges of stairs are exposed to heavy mechanical stresses and represent a high risk for injuries. Because of their slip-resistant design and excellent visibility, TREP profiles improve safety and offer DDA compliance and protection.

Problem: Attaching shower screens without compromising waterproofing measures
Solution: Schlüter-DECO-SG
Using screws to mechanically attach shower screens means that waterproofing is punctured and needs to be resealed. The DECO-SG profile allows for screw-free installation of shower screens, featuring an anchoring leg that is bedded into the tile adhesive and a U-shaped recess into which the glass is inserted.

Problem: Accommodating movement of tile fields in a discreet fashion
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Cost Effective Aluminium Replaces Standing Seam Detail on Housing Development

Beaulieu Chase is a prestigious new housing development in Chelmsford, the completed properties have a stylish contemporary design, with living areas over three floors. Specialised Fixings were awarded the contract to supply and install Fascia's, Soffits, Coping and Entrance Canopies to 108 properties. A variety of factors meant that a cost-effective alternative was required for the zinc standing seam element and after consultation with the architects, Specialised Fixings and **ARP** agreed that aluminium would be a suitable option. ARP produced samples which were polyester powder coated to the colour specified by the Architects new designs and then fitted to a mocked-up roof for approval. Aluminium is a great material for new build contemporary properties like these. It is non-corrosive, and fully formable enabling it to mimic other building materials. It will also enhance the architectural elements of a building. The Trueline Fascia, Soffits, Copings and Entrance canopies used in this development will last for many years to come, with little maintenance. Aluminium is fully recyclable and can be powder coated to any BS or RAL colour.

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Knauf AMF metal ceilings complete hotel

Five **Knauf AMF** ceiling systems, including the metal ceiling range AMF MONDENA® have been installed throughout the architecturally exciting Amarin Hotel in Rovinj, Croatia. Using design to differentiate between 'adventurous' and 'quiet' zones within the hotel's interiors, the architects wanted the ceilings to create visual contrasts to the otherwise dominant white surfaces. In the hotel's reception and bar AMF MONDENA® fulfils the design criteria for an edge-free, mirror finish, metal ceiling system helps create a sense of elegant, opulent modernity.

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A special facade for a special store

The premises of the Østjysk Våbenhandel in Denmark can be clearly seen from a major motorway. For customers, as well as those driving past, the unusual facade of this building catches the eye and is a landmark for the area. **RMIG** have manufactured and supplied 400 m² of perforated sheets that make up the facade, and with RMIG ImagePerf, a giant motif of a pheasant in flight decorates the building. The large open area of the perforated sheets provides good visibility of the outside surroundings for those using the building during the day, and at night the lights in the store's foyer shine through the perforation, accentuating the stunning image.

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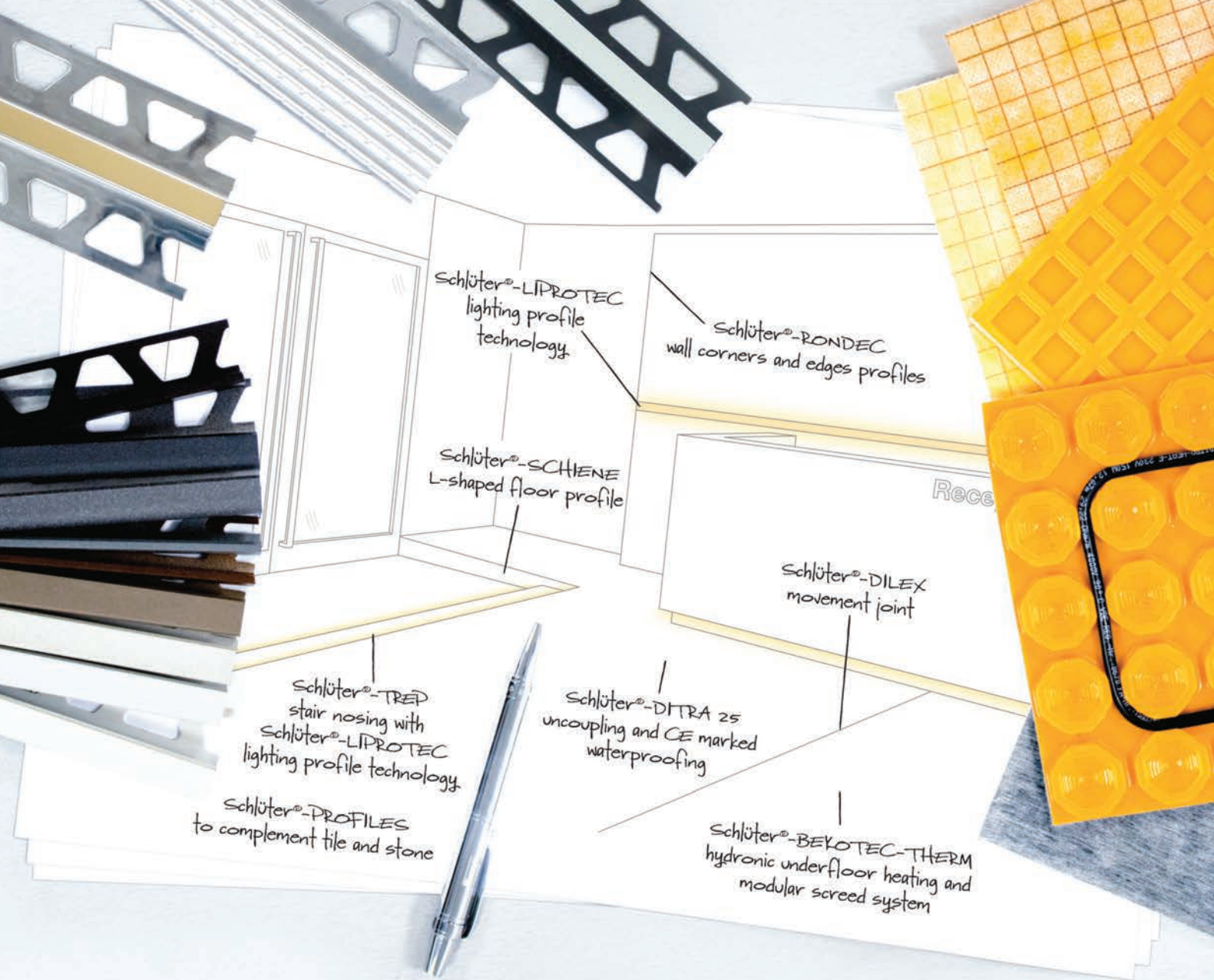

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