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Metal in Architecture Supplement

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FROM THE EDITOR

The project report in our special supplement devoted to architectural innovation with metal uses the material (plus LED lighting) to boldly display its identity on its exterior. The School of Digital Arts at Manchester Metropolitan University sees the Bath office of the currently very prominent practice Feilden Clegg Bradley Studios using metal to give a strong identity to a new, largely windowless structure competing for attention in a tight urban campus.

The building's frontage is covered with a relatively 'low res' (and therefore less energy intensive) LED screen, which still however enables a 20,000 pixel moving image. This means that work by the college students, staff and other artists can be vividly displayed, to show the fruits of the academic faculty as it innovates the design of ubiquitous screen-based work in all its forms.

While this is a very vibrant way to use metal allied with light to really bring a facade to life, the subtle metal cladding surrounding the rest of the building should not be ignored. The elegant, somewhat zinc-like folded aluminium pleats provide texture and variation throughout the day, and show how what could be an austere, monolithic 'box' can become a celebration of materiality.

And this came from locally-sourced workmanship, being sourced from a Stockport supplier who did all the folding. This kind of sensible but artful metal architecture shows what can be achieved if you speak to suppliers and fabricators early on; you might not realise that they are capable of providing!

This supplement also includes some insightful comment from copper firms on the timeless aesthetics of that material, a great zinc case study at the University of Cambridge, aluminium's security credentials, and the merits of steel roofs. We hope you enjoy reading.

James Parker, Editor

ON THE COVER...
The Manchester Metropolitan University School of Digital Arts (SODA), designed by FCBStudios featured a five-storey digital light wall where thousands of LEDs are mounted, displaying the work of staff & professional digital artists.
Cover image © Hufton + Crow
For the full report on this project, go to page 16

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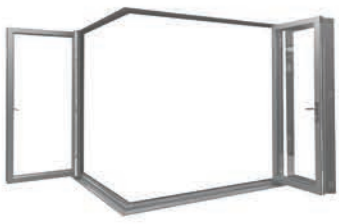

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THAILAND

Bangkok's titanium-finished office

Designed by IDIN Architects, the Suanphlu Office – in Bangkok, Thailand – is situated next to the historical Lao Pueng Thao Kong shrine and comprises a private office with the owner's penthouse located on the top floor.

The proximity of the shrine is an important factor in the facade design. Not only does the design have to take into consideration the view from the office, and the amount of sunlight, but also the facade of the building serves as a backdrop for the community with the potential to reflect the harsh sunlight onto the neighbouring shrine.

The double skin facade is designed to protect the building from the harsh sunlight, reduce the reflection on the glass facade, and encourage wind flow and ventilation. The building's glass facade is covered by the aluminium cladding to reduce the heat and the amount of sunlight entering the building, while still providing visibility to the outside through its clear, perforated and opaque design.

The semi-gloss titanium panels are positioned at different angles which result in a shadow pattern that changes throughout the day. The planes are bended in different angles to avoid sunlight reflection onto the neighbours while the diagonal cuts in the design visually separate the facade into panels across the building, "creating movements and adding dynamic," said the architects.

The building features "concave insertions of green pocket courts, climbing from the base up the side." The pocket courtyards are continuously placed on each level alternatively from floor to floor resulting in the different layers of green views. This idea improves the building's elevation aesthetics, and creates views of pocket greenery for the office spaces inside the building.

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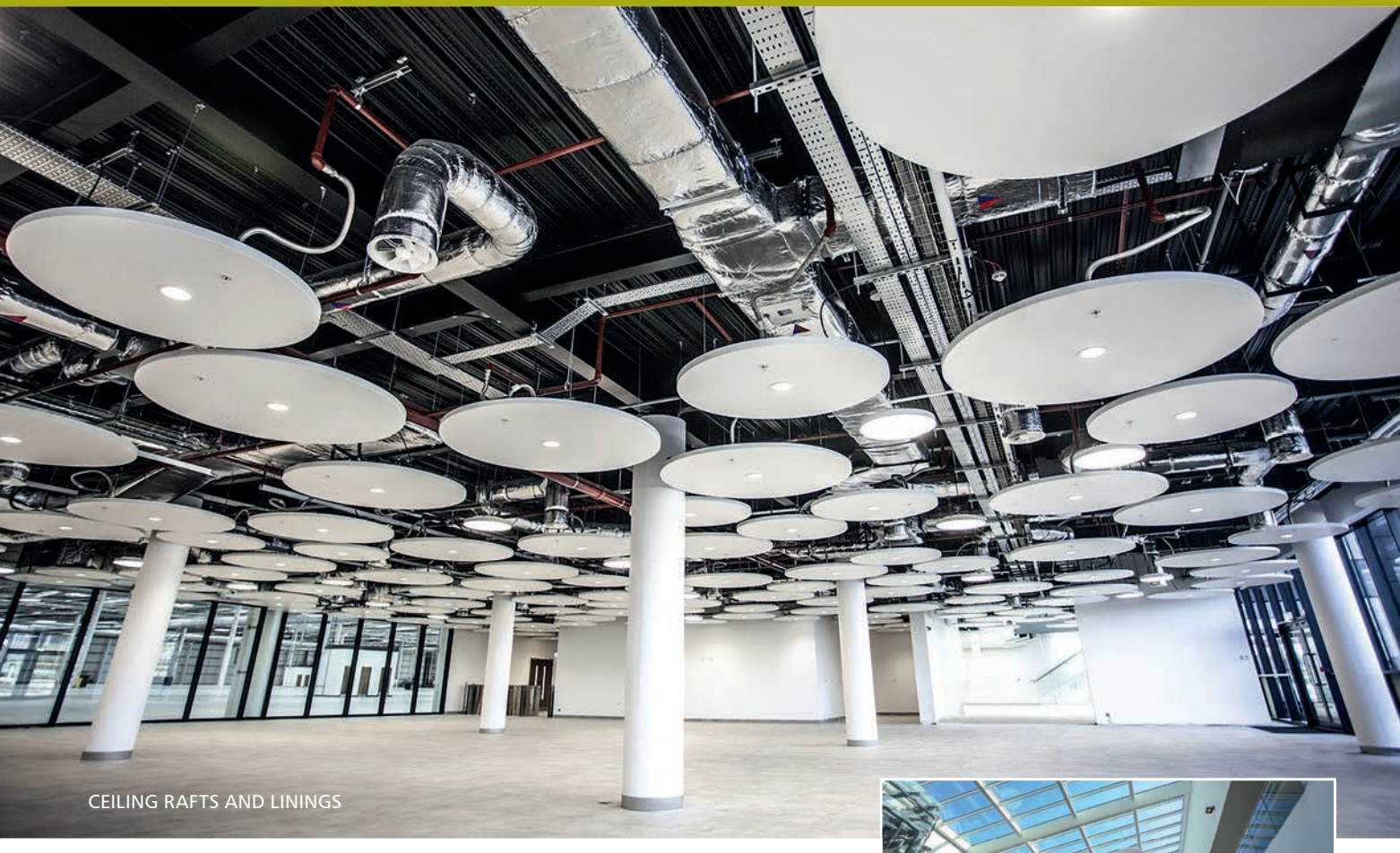
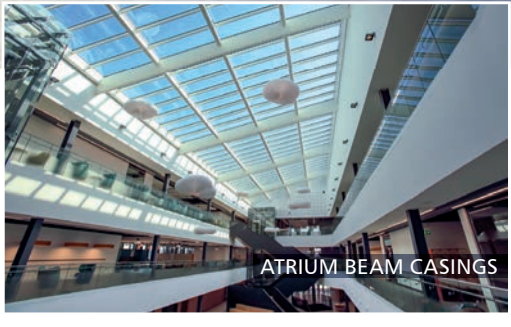


CEILING RAFTS AND LININGS



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BUILDING LININGS

ALUMINIUM

Aluminium-clad training hospital

Designed by Pick Everard architects, the £15m 'mock hospital' – at Nottingham Trent University's Clifton Campus – will help train healthcare professionals in a realistic hospital setting, including hospital wards, consultation and counselling rooms, and even lifelike patient mannequins to give students the experience of working with a variety of injuries.

The architects specified Coil Pre Anodised Aluminium for the entire external element of the new Health and Allied Professions Centre. The cladding panels were supplied in a mix of Bronze B40 Satin and Bronze B40 Brushed finishes.

The shade variation across the facade is created by the satin and brush effects on the base metal being applied before the anodising, creating an effect that adds interest and visual appeal. "The subtle bronze hues embellish the natural surroundings of the building. When used for the soffits, the semi reflective satin finish has the effect of visually elongating the large vertically framed glazing elements upwards and outwards" said the architect.

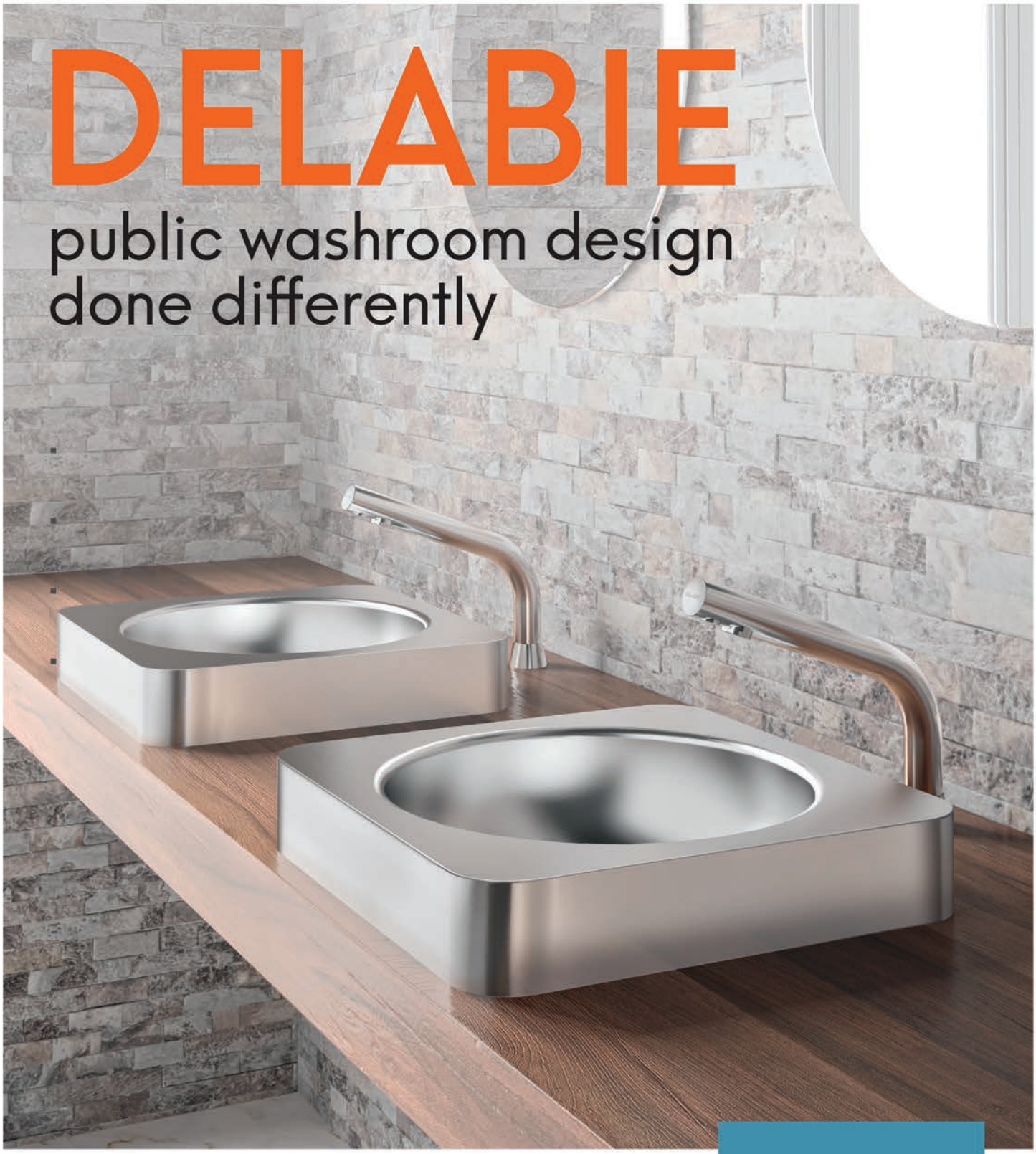
Pick Everard had originally envisaged coloured stainless steel, however decided that an anodised finish would offer a similar type of textural change across the elevation. At the same time, the coil pre-anodised aluminium still achieves the life expectancy required and with minimal facility management requirements.

As part of the complete facade solution, the cladding wraps into the soffits on the front of the main building using the same panel system, with the addition of a flashing cill in identical bronze finish.

This integrated approach extends to the other elevations, including manufactured jamb, head and cills flashings for pocket windows in matching coil pre anodised aluminium bronze.

The integrated, lightweight, high strength modular rainscreen cladding system has a honeycomb core that offers an optically flat panel, and meets the requirements of BS476: Parts 6 and 7, therefore achieving a Class 0 rating as classified by building regulations.

The project was shortlisted in the 2022 Facade Awards for Best use of a Rainscreen System using Aluminium.



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COMMENT

Timeless architectural copper

Copper continues to intrigue and inspire architects. With limitless possibilities for innovative contemporary design, copper also provides exemplary recyclability, sustainability and longevity explains Chris Hodson from Aurubis

As one of our oldest building materials, copper's unique, timeless architectural qualities are defined by its naturally changing patina – which cannot be successfully replicated using other materials with surface coatings. The patina film provides impressive protection against corrosion and can repair itself if damaged, giving it exceptional longevity. Within a few days of exposure to the atmosphere, a copper surface begins to oxidise, changing from the 'bright' mill finish to a chestnut brown, which gradually darkens over several years to a chocolate brown.

Developing visual characteristics

Continued weathering can then result in development of the distinctive green patina – or blue in coastal locations. This process is an expression of the metal's propensity to revert to mineral compounds that resemble the ore from which it originally came. Some rainwater is needed for the patina to form and its rate of development will depend on the water "dwell time" on a surface. As a result, vertical cladding and sheltered surfaces will take much longer to patinate naturally than exposed roofs.

Airborne pollution also increases the rate of patination, which therefore takes longer in more remote, cleaner environments than in cities or industrial areas. The complex combination of factors determines the nature and speed of development of patination, giving copper unique, living visual characteristics developing over time in response to local conditions.

Natural material

Today, factory-applied surface treatments can provide oxidisation and patination of copper straight away to a selected level. This is particularly useful for vertical surfaces which might not otherwise ever develop a blue/green patina. The processes involved are very similar to those taking place in the environment – not alien chemical reactions. They bring forward environmental changes without taking away the integrity of copper as a natural, living material.

These surface treatments form an integral part of the copper and are not coatings or paint. They utilise the same brochantite mineralogy found in natural patinas all over the world. Oxidisation can be light or dark, and with pre-patination the process can be

TEACHING AND LEARNING CENTRE FOR BIRKBECK, UNIVERSITY OF LONDON
A theatrical rooftop extension, clad in copper, announces the new teaching and learning centre for Birkbeck, University of London © Timothy Soar

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ABERDEEN ART GALLERY
This modern addition to the Aberdeen Art Gallery is clad with vertical, scalloped panels – including some perforated for transparency – of pre-oxidised copper, complementing an original dome repaired with pre-patinated copper © dapple photography

WINDERMERE JETTY MUSEUM
The Windermere Jetty Museum is unified and defined by facades and oversailing roofs clad in pre-oxidised copper, folded and pinned with a regular pattern of brass fixings to give the elevations a unique texture © Christian Richters.

accurately controlled so that, as well as the solid blue/green patina colours, other intensities of patina flecks can be created revealing some of the dark oxidised background material to give a 'living' surface. In addition to all these natural surfaces, copper alloys – including Bronze, Brass and a more recent golden material – add to the architectural copper palette.

For restoration projects, unique pre-patinated copper material can now be produced to match the naturally patinated copper on a building. An original sample from the building is used but initial development can be started with photographs. Often, the original copper removed from a project can be recycled for reuse on the same building.

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 enabling transparency.

Sustainability credentials

Combinations of these numerous natural surfaces, diverse forms and innovative installation techniques offer architects a new design freedom – enhanced by copper's exemplary sustainability credentials. Copper is a natural element within the earth's crust which has been incorporated into living organisms throughout the evolutionary process. It is non-toxic and its inherent antimicrobial qualities make it ideal for touch surfaces, including interiors.

Copper can be recycled again and again without any loss of performance or qualities

As a lightweight and flexible covering in buildings, structural support demands are reduced, resulting in lower carbon and 'whole of life' costs. Then, at the end of a building's life, copper retains a high scrap value which drives recovery and recycling. In fact it can be recycled again and again without any loss of performance or qualities, and its lifespan can be regarded conservatively as 200 years when correctly installed. When copper roofs or facades are replaced, it is generally due to substrate or structure failure, rather than the copper.

And 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 an 'A1 (non-combustible material)' fire classification to EN 13501-1, copper is suitable for cladding tall buildings, using appropriate constructions. Low thermal movement makes it safe and straightforward to use in any climates and locations.

Chris Hodson is an architect, writer and consultant to Aurubis

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BUILDING PROJECTS

SCHOOL OF DIGITAL ARTS
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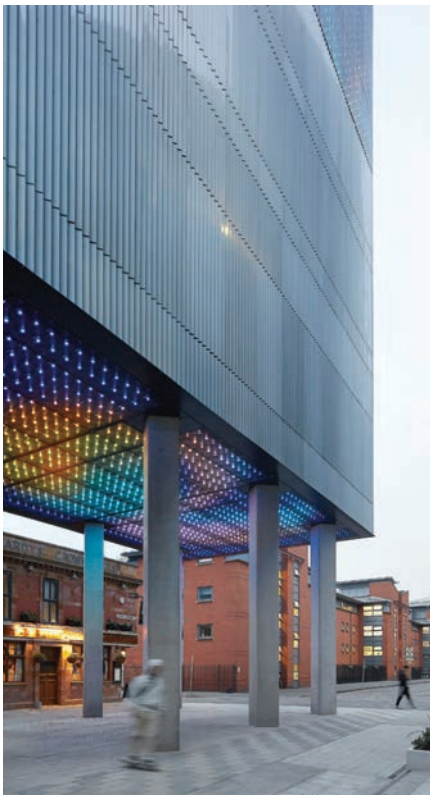
Screen test

In creating a unique digital art school for Manchester, Feilden Clegg Bradley Studios enlivened windowless facades with a giant LED screen displaying students' work, surrounded by bespoke, pleated aluminium. James Parker reports

The Manchester Metropolitan University School of Digital Arts (SODA), opened in November 2021, with a promise of a genuinely new kind of art school in the UK. Covering a range of disciplines – but with an overriding focus on the design of screen-based activities – it has been designed to relate closely to the existing School of Art and Design next door. Also designed by Feilden Clegg Bradley Studios (FCBStudios), the latter was nominated for the Stirling Prize in 2014.

The £35m project, says Steve Wilby, associate at FCBStudios, finds the practice taking its strong existing relationship with this client up a notch, reflecting the uniqueness of this scheme. The building covers "everything to do with the screen from apps to feature films" and relates to digital devices large and small, he says. This includes refining the design of screens to enhance how we interact with them – which in turn influenced this project. "The design is lean, and industrial, but as with the junction between your phone casing and its screen, the transitions help create a unified, seamless whole." Here, this transition was between a giant digital screen and SODA's protective, pleated cladding.

FCBStudios won a design competition run by the university in 2016. This is the sixth commission the practice have



The light wall is designed to be low-tech (only operating when the building is open), composed of flexible strands of high-intensity, full colour LED 'nodes' enabling a 20,000 pixel moving image

completed for MMU. According to Wilby, it's the first higher education building in the country "where you can make a film, do the effects and post-production for it, and screen it, all in the same building." Courses run here include film, animation, UX ('user experience') design, photography, games design, and AI (artificial intelligence).

The completed building contains a "digital innovation lab," as well as open workspaces, green screen studios, editing suites, and a screening space; there's also a media gallery, sound studios and production studios. At the heart of the building are a series of shared work and social areas, including a double-height 'digital hall,' and open seminar spaces designed to foster collaborations between students, and between staff. The top floor is dedicated to music, with a series of music production and edit suites connected via video links.

The brief was for a very open building, partly driven by the client's agenda to "interlink the whole arts campus," says Wilby, given the synergies between many of its disciplines. It also needed to be very flexible, given the uncertain nature of future development: "No-one knows where digital is going to be in 10 years, so we had to make the building lithe enough to cope." The concrete frame was fundamental to this, Wilby says that it allows for potential future additions like a mezzanine to simply provide, for example, an extra 500 m² with "no compromise."

Site & Form

The architects' focus was "simple, robust design," and being as energy efficient as possible, says Wilby. The straightforward form was "basically an extruded cube, with low volume to area ratios."

The site, on the edge of the campus, was challenging to work with – being a former car park, including a road running through it. Early in the project, the architects reviewed the masterplan with the client to "unlock" the idea of removing the road, says Wilby. This opened up opportunities for connections to the art school, as well as sending out a positive anti-car use message. It would also enable the architects to extend the form of the new building out further, giving it a stronger identity on the campus.

The concrete-framed building has been designed without an explicit 'front or back,' as there is a possibility of the campus being extended in future. Following the brief, the designers stripped back what would have been a larger form, "fitting in all the technical spaces, but

working with the university to get a leaner building," for example introducing hot desking and proposing shared seminar rooms and support spaces in SODA's adjacent buildings.

Wilby says the site enabled the architects to take a genuinely fabric-first approach to benefit efficiency: "We placed the circulation core and black box studios on the south and west elevations respectively, to prevent heat gains normally associated with windows on these orientations."

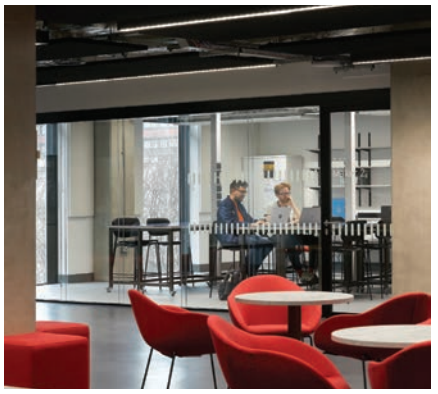
There was an interesting architectural conundrum in that due to the building containing 15 film studios of different sizes and types, around 60% of the overall structure didn't require windows. This meant "pros and cons" for the designers, says Simon Wilby, because while avoiding windows due to overheating is a sustainability plus (and wasn't required for the centrally-placed cinema), there was also the danger of presenting a featureless box to the community externally.

Seminar rooms have been placed on the east flank, benefitting from the connection with the art school on that side. "There are very large windows which are aligned with those on the art school," says Simon, giving a "very visible connection between the two buildings" when students are working there.

A sense of movement

Wilby says the building was somewhat "tucked away" in a fairly dense urban context between the art school (with a new pedestrian access between) and a pub. FCBStudios arrived at a striking means to signpost it, and the work within. At the entrance (on the northern facade) is a five-storey digital light wall where thousands of LEDs are mounted, displaying the work of staff and professional digital artists, and also enabling signage.

Steve Wilby says that displaying the college's work so visibly "will help to make wider connections, placing their work within the city." Also communicating the "movement" inherent to the school's work, is the pleated, mill-finished aluminium cladding whose appearance changes with the weather thanks to its reflectivity and makeup. An attempt to maintain the "exciting culture" of its art school neighbour, the composition of closely-ranged folds changes as the light changes, and produces a texture that varies depending on the angle they are viewed from. The architects "spent a lot of time getting the reflectivity right," in the end opting for a clear (depigmented) powder coating, "essentially a clear lacquer which massively increases reflectivity," says Wilby.



They were careful to avoid overdoing it, particularly as the elevations face offices within the art school.

The "creases," as Simon describes them, were a product of seeking local manufacturers and suppliers, and a drive to make material use as lean as possible. The designers discovered a local metal facade supplier in Stockport who could fold the material, which would minimise the gauge required. The resulting creases are at 80 mm intervals, reducing the volume of material required along with the embodied carbon of the facade. To help create a unified, seamless link between the digital screen and cladding, the architects designed an extruded aluminium 'Y' detail at the corners of the facade into which the pleats "dovetail neatly." Conversely, to break down the facade at ground level, there are 30 mm joints providing a 'banding.'

Fitting the straightforward design approach taken throughout, the light wall is designed to be low-tech, composed of flexible strands of high-intensity, full colour LED 'nodes' enabling a 20,000 pixel moving image. The screen is only operational when the building is open, so rather than have a blank screen, the 'net' of LEDs mounted on metal cladding panels has been integrated into the facade, sitting behind a perforated black metal rainscreen. Being on the north facade means that sunlight won't interfere with the images, and the perforations assist viewing the overall image thanks to the 'moire' effect created. Wilby says a "lot of mock ups" were constructed to make sure that the perforations were sized correctly, both visually and to avoid wind noise.

To help create a unified, seamless look between the digital screen and the pleated cladding, the architects designed an extruded aluminium 'Y' detail at the corners of the facade so that the pleats "dovetail into it neatly." Conversely, to break down the overall look, there are 30 mm joints providing a banding at ground level.

With animation and video being the order of the day, the wall's typical energy use is likely to be 25-30% of the wall's 16 kW rating, and thereby handled by a PV array on the roof. (The architects have provided infrastructure for a full array in future which could completely power the screen on its own). FCBStudios "reverse engineered" the screen design in terms of power requirements, working out what the PV array would be, and then sizing the screen to be completely powered by it.

The architects "fought hard" to make the light wall as big as possible, says Wilby, without adding to energy demand.

FLEXIBLE GALLERY
The building includes a flexible gallery space around the ground floor's perimeter, which can be connected to the entrance area for events
Images © Hufton + Crow

FCBStudios took the normal LED distribution for a 4 metre x 5 metre screen model and "super-stretched it" (the normal 10-50 mm spacing expanded to 300 mm gaps). He explains that because the screen can be viewed from 100 metres away down the main route from the business school, it can be a lower resolution as it's often seen from a distance. A variety of innovative ideas for the screen, such as playing classic computer games, or testing the digitising of fabrics in different wind conditions have already been explored by the faculty.

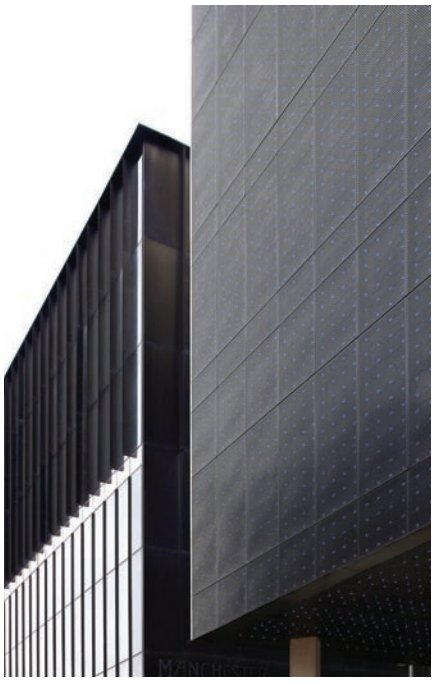
Programme

Of the 5,600 m² interior, Steve Wilby says: "We wanted to literally remove boundaries, so that everyone is sharing open spaces." For example, on the east flank while some similar projects might have a collection of similarly-sized seminar rooms arranged across the floor plan, the designers "asked the university 'do you need these rooms?'" He adds: "If we were to take the walls away, you could get one very flexible 150 m² space, and by avoiding having the circulation, increase space by 15%."

This resulted in a pair of 'village green' spaces which function as collaborative, open working areas. Located at levels two and four, they provide a relief from the black box studios, as generous open areas with large windows bringing daylight in. These spaces were originally "much smaller," but through conversation with the client, the architects "managed to shake those out." Their generous proportions allow them to be configured in a "multitude of ways" to suit different future needs.

The two village greens act as 'melting pots' where students from different disciplines can interact and share knowledge; augmented by further 'collab modules.' The building is designed so that seminar rooms and studios for different disciplines are located next to each other, "so you get those interactions, incorporating thoughts from other parts of the school, such as fashion and fabrics," says Steve Wilby.

A double-height 'digital hall' at ground floor provides informal break-out space alongside a café, foyer, screening room and exhibition space which support the specialised studio spaces. It also provides some 'passive supervision' externally for students with a light wall which projects light out to the pedestrian area through the glazing. There's a gallery space on the perimeter, which can be connected to the entrance area for college events such.



The university had an overall aim to achieve a campus that incorporates environmental sustainability into all aspects of the estate

A further example of the open plan approach is the staff offices, whose design is hoped to promote better connection between staff and students. In all spaces, finishes are "deliberately limited and restrained" say the architects, which allows them to be easily reconfigured, with the interior design deferring to the effectiveness of the students' collaborative work.

The concrete frame provided important acoustic benefits, crucial in this project, and with the building being highly serviced, the architects were able to expose services to again limit the mass of the building. Wilby believes that making the building's structure and services readable is very important in education facilities, showing how it is constructed, but also in suggesting how it could be adapted. Internally, much of the fixtures and fittings are movable.

Sustainability

The university's aim was to incorporate environmental sustainability into all aspects of the campus. As well as the fabric first approach, passive design principles were also used, including high insulation levels. It is a leaner building than the brief, with both higher activity, and better environmental quality for users.

SODA features "low energy active systems," accredited using BREEAM and an "environmental sustainability project tracker." Carbon analysis (using the practice's own FCBS Carbon calculator tool) produced an "upfront A1-A5 carbon" figure of 608 kg CO_2/m^2; the result of the lean approach to materials use. This meant only applying internal finishes where required for performance – e.g. for noise reverberation. "High embodied energy soft floor finishes" were minimised, ceilings omitted to expose concrete soffits (and services), benefitting thermal mass.

Transport distances were minimised using local suppliers where possible – such as in the case of SODA's innovative aluminium cladding. This was designed to be demountable, and potentially reused. ■

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Security without compromise

STS202 is changing the game for security standards across the construction sector. Ash Pearson from Jack Aluminium talks us through the specification and what security benefits it can offer for buildings

When standards for products rise across the board, so too does confidence in our industry

Security should always be a concern, but never an issue. When it comes to the design and specification of a project, clients will likely be heavily concerned with the security and safety of their building. Alongside thermal and acoustic efficiency, builders, developers, and end-users will want the reassurance that their building or renovation project will be safe, secure, and designed with their needs in mind.

This is important, regardless of whether or not the building is designed for commercial or residential use. Entry-point such as doors and windows are naturally going to be targets for theft, particularly for commercial buildings. Currently, the minimum standard for glazed aluminium window and door security is PAS24:2016, which is a prerequisite for Secured by Design (SBD) accreditation.

What is PAS24:2016?

According to PAS24, door sets and windows must be capable of offering a level of security suitable for dwellings and other buildings exposed to similar risk. This is normally coupled with the requirements of BS6375, which covers weather-tightness and other hardware considerations for aluminium windows and doors.

PAS24 accredits the door set as fit for purpose and the testing process is designed to mimic an attack by an opportunistic burglar, using tools that would be easy to conceal. PAS24 offers a rigorous testing procedure which focuses on the whole frame, testing for vulnerabilities in the system which would allow a burglar to gain entry. PAS24:2016 has set a universal standard for the industry and has been instrumental in maintaining a level of accountability for contractors and fabricators.

STS202: burglary resistance

The updated STS202 standard is a requirement for burglary resistance on a range of construction products, such as door sets, windows, curtain walling, shutters, garage doors, etc. STS202 specifies the use of a range of attack tools that would ordinarily be used by "professional" criminals attempting to gain entry.

The tests focus on high-intensity, consistent attacks on the door set itself, locking cylinders, beading, and most importantly the glazing unit. These standards far surpass the type of attack ordinarily perpetrated by an opportunistic thief or burglar. Both tests offer strict standards that certify aluminium door

sets as offering solid levels of resistance, however STS202 specify a range of attacks which focus on areas most likely to be targeted by burglars, such as glazing units.

Each system is graded along a scale of Burglary Resistance (BR), from BR1 through to BR6. Naturally, BR1 offers a lower grade security rating and BR6 a higher one. Similar to the LPS1175 Security Rating (SR) system, of which STS202-BR is equivalent to. BR1 and BR2 focus on low-noise break-in attempts which commonly use levers, physical force, and hand tools such as spanners, lock picks, and screwdrivers.

Unlike PAS24, which is a pass/fail certification system, the different grades of burglary resistance provide an indication of how well each system would fare against a prolonged, sustained attack on each of its key components.

Ordinarily, increased security performance comes at the expense of aesthetics, and projects can quickly become compromised due to an overly attentive lean on the most minute details in order to give your client that extra peace of mind. By testing glazed aluminium doors and shopfront systems to a higher standard, we remove the need for gratuitous security measures that compromise the look and feel of a building.

What does it mean for the industry?

An increased reliance on high-security systems can only mean great things for those of us working in the construction industry. Buildings are more secure as key entrance points that would usually be vulnerable, such as windows and doors are far more difficult to enter. Even for experienced criminals.

Clients in commercial or retail sectors will naturally want a higher degree of security than what is normally offered by PAS24 and its certification for windows and doors in a residential property. More robust, high-security options are crucial for protecting a client's stock, assets, or anything of value to would-be thieves.

As the STS202-BR standard is adopted by the sector, it also means that architects and specifiers are able to recommend or choose door systems that offer higher levels of security. When standards for products rise across the board, so too does confidence in our industry.

We should be offering higher levels of security as standard, without any unnecessary need to adapt or change a product to suit a project's security demands.

By expanding the range of fully tested commercial door options to meet today's market demand, we can give architects and specifiers a full suite of high-performing aluminium door options that provide the excellent levels of security necessary for high-specification commercial projects.

When choosing windows and door sets for a property, save you and your client valuable time on site by choosing systems accredited with STS202-BR. A more robust and comprehensive security testing option that offers peace of mind, without the need to compromise on design.

Ash Pearson is sales manager for Jack Aluminium

By testing glazed doors and shopfront systems to a higher standard, we remove the need for gratuitous security measures that compromise the look and feel of a building

Capitalising on copper

Simon Walker from SIG Zinc & Copper shares his knowledge and insight into the benefits and approach to using copper in builds

Copper is known to provide an ideal solution for designers looking for a cladding which is highly malleable

For designers and architects, selecting the most appropriate solution for cladding or roofing involves finding a balance between aesthetics, sustainability, and durability.

There is no definitively right answer, and with a plethora of options available, designers have a lot of decisions to make. Even when a metal solution seems obvious with its long life, there is still the choice between aluminium, steel, zinc, and copper. The performance characteristics of each material, as well as their very different aesthetics, will all influence the choice.

Copper is known to provide an ideal solution for designers looking for a cladding which is highly malleable – key for curved or irregular shapes – while still being long-lasting.

This malleability makes the material popular with designers looking to work with the same metal finish for gutters, downpipes, and flashings. It's an established practice to use copper for cappings, ridges, flashings and full rainwater systems because of the metal's comparative softness and ease to work with.

Being a lightweight material makes it easy for contractors to work with too. The traditional 0.7 mm size used for standing seam roofing, angle seam cladding and shingles or flat lock weighs only 6.3 kg/m².

Conversely the lightweight nature of the metal can result in natural undulations, particularly on flatter sheets, which some designers or clients might find unappealing but for others is part of the charm of the material.

Copper has a unique ageing process that causes the material to change its appearance radically over time. Starting from a bright traditional copper colour, the hues change to brown, dark brown, and eventually end in Verdigris.

For designers who want certainty on the appearance of the material over time, pre-weathered copper is widely available to give a specific colour or weathering stage of the

material. Also available are different alloy compositions such as brass and bronze with their own ageing characteristics.

Each of these options give their own distinct colouration, together with different levels of strength or corrosion resistance and can improve forming or joining properties. Different finishes including gold or tin are available for designers seeking the perfect finish.

Considerations for design and installation

Different materials will also offer a range of options for specific installation techniques with copper being an excellent choice for traditional seam roofing, angled seam facades, shingles, and flat-lock tiles as well as for prefabricated and engineered solutions.

Ventilated facades allow for the circulation of air between the cladding and the substrate to regulate temperature as well as reducing water damage, mould, and structural damage to the building. For copper, air flow and ventilation are not essential for maximising the lifespan of the material and therefore can be used in the design of both ventilated or non-ventilated roof and wall systems.

Regarding fire specification and protection, it is always recommended to engage with a distributor to assess systems that can offer advice and system warranties for applications when installed correctly. For context, copper sheets and strips achieve Reaction to Fire Classification A1 according to EN 13501-1. This means the product is non-combustible/no contribution to fire.

Maintaining copper on facades and roofs

Copper is generally a maintenance free material as rainfall is typically sufficient to clean the surface area in most situations. Typical maintenance best practice measures should still take place, such as visual inspections to ensure no obvious signs of damage or build ups in gutters. In most instances, regular cleaning or a dedicated maintenance regime isn't required.

If specified correctly, designers and building owners can expect the copper cladding or roof to last for many decades. The exact duration of the lifespan varies depending on specification and installation however copper can be relied upon to be an enduring metal to work with.

Copper has a long life span and when reaching the end of the life cycle, copper can be recycled without loss of performance. This is, in part, because copper can be installed in roofing with no underside corrosion issues which can affect other non-ferrous materials.

Typically, if the copper is uncontaminated, it can be melted down and reformed ready for use. For copper which does contain other impurities, it's possible to adjust composition by introducing other metals, or by re-refining it to make an acceptable specification, thus keeping the copper in use.

With all its aesthetic and practical advantages it may not be surprising that copper is likely to be an expensive option in comparison with other products. Due to supply and demand, we've seen market price increases of up to 20% which does limit its usage. Most affected will be smaller, domestic projects or on specialist finishes where minimum order quantities can affect buying power.

On larger commercial projects, we advise early engagement with the supply chain to ensure availability. On average, expect 12-16 weeks for manufacturing however this can be accounted for when factored into the project programme.

For designers and architects, copper represents an ideal solution for a building material combining a long-lasting life span with a unique and desirable aesthetic. The ease of installation and minimal maintenance required can be seen to offset the price bracket and when factored into plans, lead times are more than workable.

Simon Walker is category manager for hard metals at SIG Zinc & Copper

Air flow and ventilation are not essential for maximising the lifespan of copper and therefore can be used in the design of both ventilated or non-ventilated roof and wall systems

Sizing up steel roofing tiles

David Padmore from Metrotile UK Ltd explores the versatile world of lightweight metal roofing systems: what they look like and their uses

In the current climate when building materials need to be eco-friendly, you are working with a product that is 100% recyclable

Even in these enlightened times, many people in the construction sector mention a 'metal' roofing system and they will conjure up a vision of corrugated metal sheets on a shed roof. For those people, they are missing out on possibly the most sustainable, eco-friendly and low maintenance roofing systems available in today's roofing sector.

These roofing systems are perfect options for residential and commercial properties; widely used for social housing developments up and down the country, and on supermarkets, leisure centres, schools and colleges, on conservatories, park homes, for vertical cladding and even on glamping pods – they are hugely versatile.

Thet are aesthetically pleasing too; steel roofing tiles look every bit as effective as traditional slate and tile roofs. Available in a range of finishes – from ground level – are almost indistinguishable from traditional options. And you can even specify metal tiles with solar panels incorporated in them if required.

Weighing up the options

Let's take a closer look at the benefits that come with lightweight metal roofing systems. The first clue is in the name – lightweight. Weighing in at around one seventh the weight of traditional roofing materials, they offer weight bearing benefits. You can transport seven times as many tiles on a truck which means far less CO_2 generated during transport, adding to its reputation as a far more environmentally friendly option.

The safety aspects of working with lightweight metal roofing systems also zannot be overstated. The weight of the tiles

on site, the ease of moving them around the site and on the roof itself, it's a perfect option for transport and loading and off-loading. The finished roofs are highly fire resistant and can even slow down the rate of spread of fires because of their construction. The roofs are also vandal proof and can withstand heavy footfall making them safe and durable, for options from residential roofs to schools and leisure centres, to park homes and conservatories.

Any organisation wanting a new way of providing roofing for their projects – with the added benefit of low maintenance – should consider lightweight metal roofing.

Longevity

Available with a 40-year waterproofing guarantee – that's the best in the sector – just highlights the longevity of this easy to install, good looking roofing option.

One of the key reasons that people choose metal as a roofing material is because it has a long lifespan. Typically, a metal roof that has been installed properly and looked after, can last for three times as long as traditional material such as asphalt.

When thinking about the pros and cons of a metal roof, durability is a key factor to keep in mind. Metal is able to withstand the elements extremely well, including harsh storms, making it an ideal choice.

And in the current climate when building materials need to be eco-friendly, you are working with a product that is 100% recyclable as well. Almost too good to be true. For more and more people, being environmentally conscious is impacting their buying decisions and they are looking to purchase materials and products that don't have a negative effect on the environment. Metal roof tiles are an excellent option for anyone who wishes to be more sustainable.

The pros and cons of a metal roof may depend on what specific project is being undertaken. For example, for those looking for a low pitch roof, a metal roof may be an ideal solution as many lightweight metal roof tiles can be used on pitches as low as 10°. Most traditional tiles can only be used on pitches of 20° or more for fear of placing too much of a burden on the roof.

Doing the sums

The size of metal roofing tiles compared to traditional ones means the price per square metre tends to be much lower for metal tiles. In addition to the purchase price, the ease of installation sees a massive saving on installation time and project costs over traditional roofs.

Lightweight metal roofing systems come with all the certificates and quality marks – ISO9001 and ISO14001 certificates, BBA, CE Mark, BIM and 3D Renders, fire ratings, CPD seminars, training, risk analysis – they are the bee's knees when it comes to making them easy to specify and install.

David Padmore is sales director at Metrotile UK Ltd

These roofing systems are perfect options for residential and commercial properties

Think zinc

Jonathan Lowy of VMZinc looks at the precise requirements of a complex metal roof and addresses the aesthetics and challenges involved

The large choice of pre-weathered zincs now available offer designers an extended palette of aspects

The new library at Magdalene College in Cambridge – designed by Niall McLaughlin Architects – sits next to part of the old Jacobean manor making the use of red brick and gabled roofs no surprise. However the building was somewhat designed from the inside out with single, double and even triple height reading areas being resolved before the exterior was designed in detail. Both the red brick and timber feature heavily on the exterior and interior but a material that is only used on the exterior is the standing seam zinc roofing. The 45 degree pitched zinc roof combines with glazed gables that give the library a wonderful luminosity with baffles reducing glare from direct light in the reading areas.

Much of the wood used on the interior is Cross Laminated Timber and this was also used as the structure for the roof. Light grey pre-weathered 0.7 mm thick zinc in 25 mm high standing seam panels, with 530 mm centre to centres, were installed over a non-vented, warm roof. A Brooft4 test demonstrating no fire spread or penetration was also carried out.

Non-vented roofing

One of the common misnomers of non-vented roofing – which is also known as warm roofing – is that the build-up is thinner than more traditional vented roofs. In reality, as all of the insulation is above the roof structure, warm roofs are nearly always 'thicker' than their cold roof

counterparts. This does however increase the thermal performance of the roof as well as reducing thermal bridging.

The 90 mm CLT structure is entirely covered with an aluminium foil bitumen backed vapour barrier (polyethylene film VCLs are not recommended as they do not self-seal when perforated by fixings.) This type of vapour barrier also acts as a high performance air barrier. 90 mm of rigid insulation with a high U value was then fitted with a specific breather membrane covering the insulation. As with all zinc standing seam roofs the panels are held in place with stainless steel clips, with five, one piece fixed clips pinning the panel towards the ridge and then two piece sliding clips, allowing thermal movement, installed at 330 mm intervals towards the eave. Clip spacings are reduced at verges, eaves and ridges. As the roof is not vented, it is vital to use a back side coated zinc – in this case Quartz-Zinc Plus – which protects the zinc from temporary humidity on the underside of the panels. The zinc roof was installed by a specialist hard metal roofing company, with a 50 year material warranty.

Zinc as a building material

Since zinc was first used as a roofing material at the beginning of the 19th century, its malleability and flexibility has meant that it is used as a material to produce gutters, downpipes and all of the flashings for not only zinc roofs but also tile and slate roofs alike. At Magdalene College the low profile ridge caps and valleys are all made from the same light grey pre-weathered zinc giving this spectacular roof a harmonious feel. A further addition to the harmony are the brick chimneys, which are a fundamental part of the natural ventilation strategy keeping the interior at an impressive 21°C during the recent record breaking heatwave.

While zinc is best known in the UK in its standing seam roofing and cladding form, the same material can also be used to create rainscreen facades – as can be seen at Lampwick Quay in Manchester. Here, the architects specified several finishes of pre-weathered zinc in various forms of rainscreen cassettes to form an impressive facade.

The large choice of pre-weathered zincs now available – ranging from engraved zinc, to zinc with discreet colour and a dark slate colour zinc which celebrates its 44th anniversary this year – offer designers an extended palette of aspects. The finish choices then combine with the wide array of systems now available on the market. By using heavier gauge zinc, typically 1 mm or 1.5 mm, back vented rainscreen zinc panels offer yet another aesthetic to fully supported panels such as roll cap, standing seam and flat lock systems.

Jonathan Lowy is operational marketing manager of VMZinc

The sustainability of galvanized steel

Galvanized steel is an integral part of everyday life and is all around us. But how does its prevalence today affect the environment of the future? How sustainable is it? What role does it play in the circular economy? And is the galvanizing process itself environmentally friendly?

Steel is essential for housing, infrastructure, transport, manufacturing, and agriculture. Used as frames for our buildings, safety on our roads, and support for the bridges we cross, we must never waste the resources used to produce it by throwing it away when the original function is no longer valid. Instead, we must repurpose steel, especially if the world wants to move away from traditional business models of use-throw-away-remake to a more environmentally friendly, sustainable circular economy that aims to eliminate waste and repurpose resources.

What is a circular economy, and how can galvanizing play a part?

A circular economy encourages materials to be made, used, reused, remade and recycled.

Hot dip galvanizing fits perfectly into a circular economy because it optimises the durability of steel (enabling it to be used again) and facilitates the ease of reuse. It can be recycled if there's no immediate need to repurpose it. Here's how:

Optimising durability

When steel is galvanized, it is immersed in a bath of molten zinc, where it alloys with the iron in the steel to form zinc/iron alloy layers. These layers form the basis of the coating, which is covered with free zinc as the steel lifts from the galvanizing bath. The result is a robust, durable, corrosion-protective finish that will last many years.

Without a galvanized coating, steel would corrode, and its lifespan would be short. However, with a galvanized coating, steel can last between 34 and 170 years before the base steel is exposed. This means that steel can be used for the original purpose for which it was fabricated, and – once the project is dismantled – the steel is still good enough to be used elsewhere.

Facilitating ease of reuse

Once a structure – such as a house or fencing – reaches its end of life, the steel can easily be repurposed if it has been hot dip galvanized. The galvanized coating protects the steel from impact and abrasion when disassembled and reassembled.

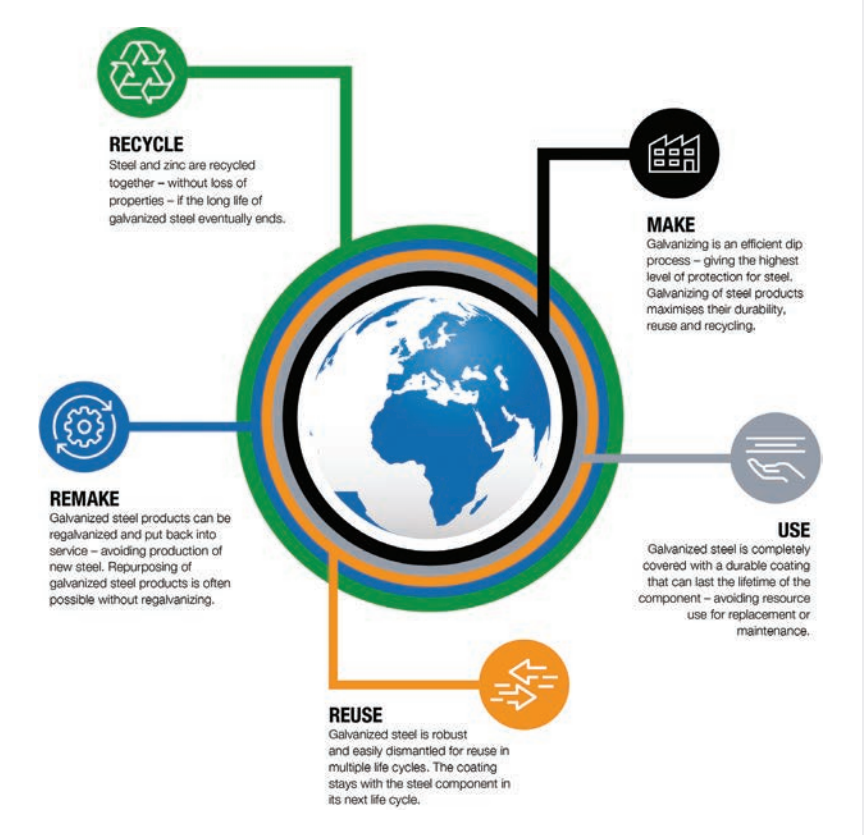
Recycling

Finally, galvanized steel fits nicely into a circular economy because it can be melted and used repeatedly without losing quality if there is no immediate need for repurposing.

The zinc coating can also be reused. Zinc and steel are recycled in well-established steel recycling processes. The zinc particulates are returned, without loss of properties, to zinc production plants, where they are incorporated into zinc ingots and reused in the galvanizing process.

How else does the galvanizing process enhance sustainability?

A hot dip galvanized finish gives steel a long life and durability. In addition, it creates a



maintenance-free finish, which lessens the carbon emissions usually associated with the upkeep of non-galvanized steel.

Mick Jackson from Joseph Ash Galvanizing says: "Imagine a bridge made from non-galvanized steel. It would need maintenance every year to protect it from rust and corrosion. It would also need repainting at regular intervals. This requires paint, a workforce, transport for the workers and a means to protect the land or water below from paint contamination. This maintenance is not required if the same bridge is made from galvanized steel, therefore carbon emissions are greatly lessened."

Is the galvanizing process environmentally friendly?

Galvanizing plants are self-contained, with steel going in at one end and the final product coming out at the other.

Modern galvanizing plants also use zinc very efficiently throughout the galvanizing process. For example, excess metal from the dipping process deposits back into the galvanizing bath. Zinc that oxidises on the surface is removed as ash and recycled, and dross from the bottom of the bath is routinely removed and has a high recycling value.

Other process consumables, such as hydrochloric acid and flux solutions, have important recycling or regeneration routes. Spent hydrochloric acid solutions are used to produce iron chloride for treating municipal wastewater, for example. Closed-loop flux recycling is also used in many plants, and improved monitoring and maintenance of flux tanks reduce the volume of solids for disposal. Compared to other coating technologies galvanizing uses low volumes of water, with plants rarely discharging wastewater. Any wastewater generated can be treated and reused, with only small volumes of stable solids requiring external disposal.

While not considered a particularly energy-intensive sector, the galvanizing industry also has set targets for energy efficiency and improved energy management. New technology has seen improvements in burner efficiency, bath lid efficiency, and reuse of waste heat to warm pre-treatment tanks. Plant emissions are also carefully controlled to ensure neighbouring communities are not adversely affected.

A solid commitment to the circular economy

Stuart Whitehouse, managing director at Joseph Ash Galvanizing, said: "We count ourselves fortunate to be involved with such a sustainable product, playing, as it does, a critical role in extending the life of steel structures by decades. In addition, reducing our environmental impact has been close to our hearts for many years, hence our heavy investment in fume capture and recycling by-products."

We firmly believe in a circular economy, where the needs of present-day society are met, without compromising the ability of future generations to meet their needs." Please contact Joseph Ash Galvanizing to find out more about galvanized steel or the sustainability processes.

Proud to Galvanize the UK

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Picture perforation for a forest facade

L'École Internationale Edward Steichen is a high school in Clervaux, Luxembourg. Jonas Architectes Associés won the assignment for construction and devised not only a plan for the buildings, but also an idea for decorative facades and sun protection. **RMIG** ImagePerf made it possible. As the school is more or less surrounded by woodland on all sides, a striking photo of a spring forest from a nature park was chosen as the template for the facade image. Using perforation in various hole sizes, the beautiful image of the forest was transferred on to metal sheets.

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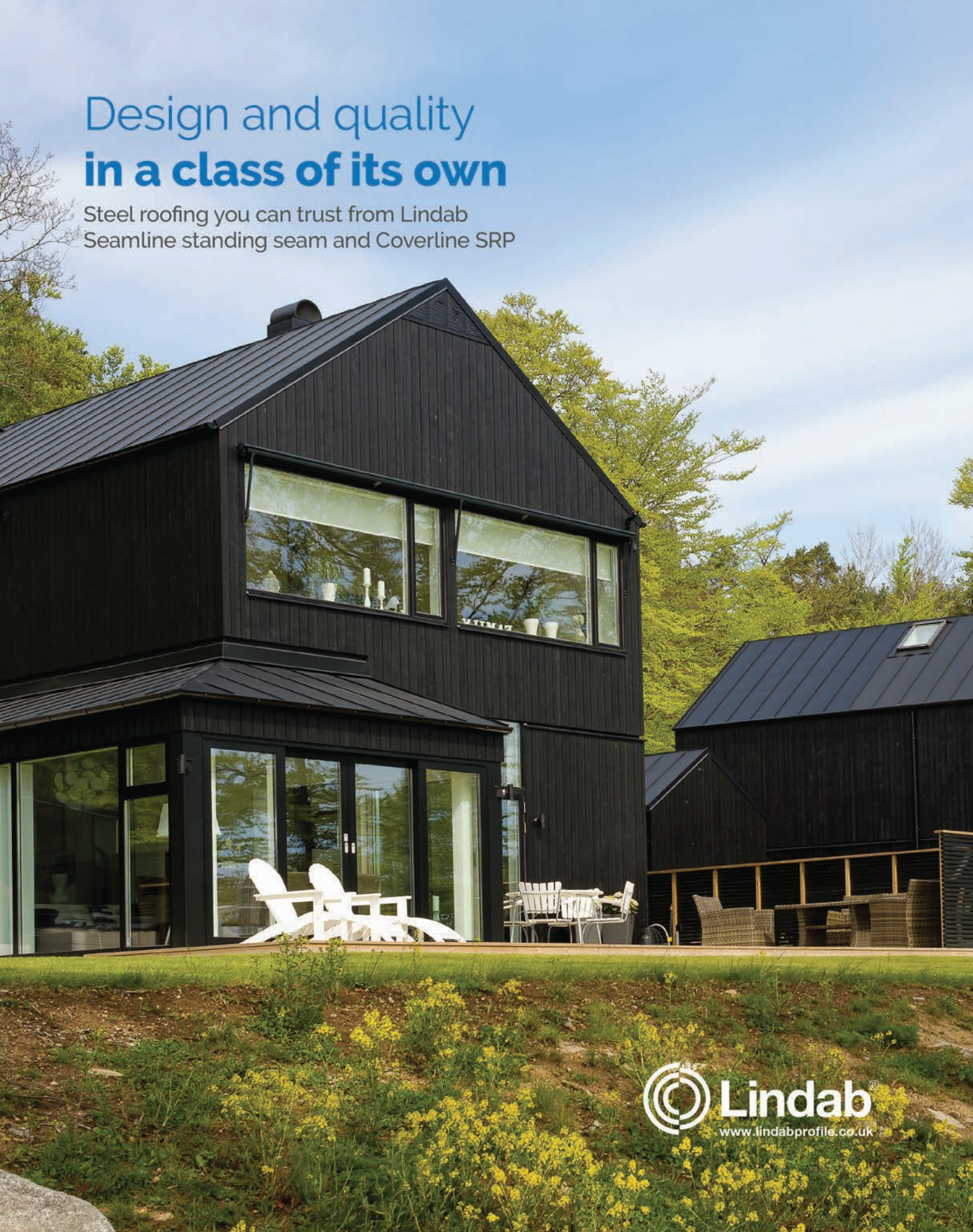
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