Metal in Architecture

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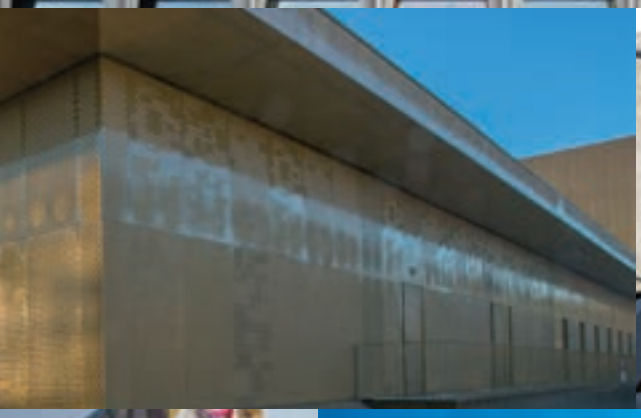
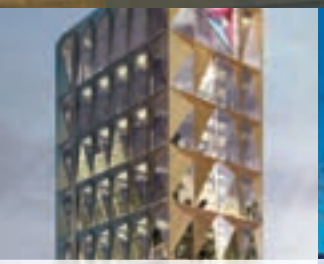
architects datafile

September 2014

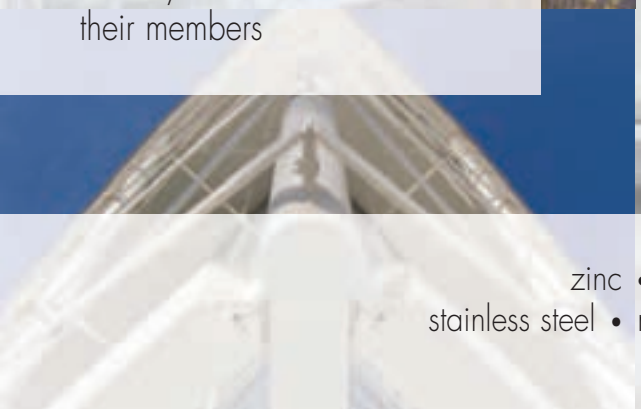




Steve Menary explores the changing use of metal in major public-facing projects from sports to leisure and retail

Pictorial showcase of innovative use of metal in architecture

Plus more projects, news and latest information from industry associations and their members



zinc • lead • aluminium • copper
stainless steel • metal cleaning/restoration • galvanizing

RCI SHOW VISIT US ON STAND E09

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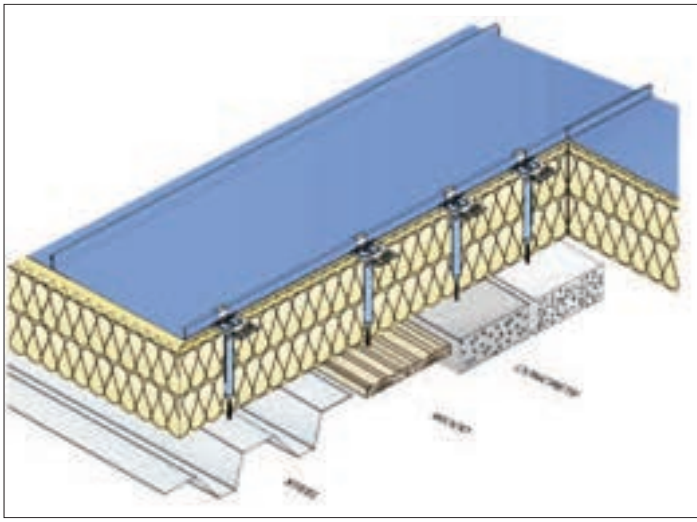
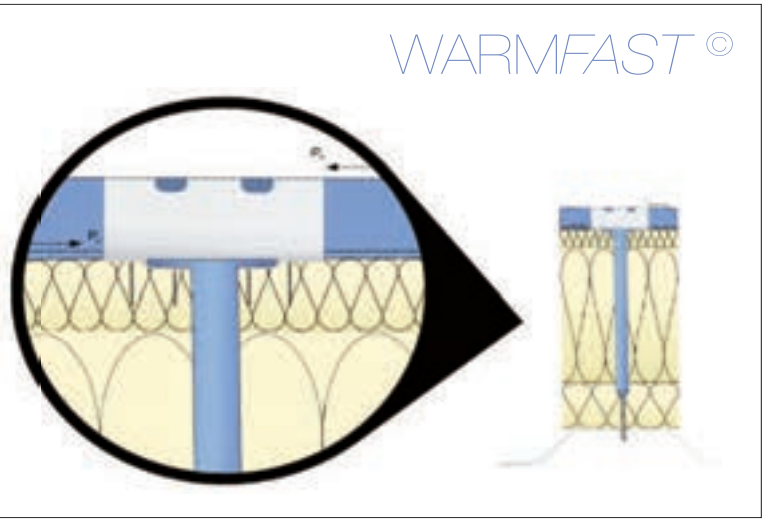
Enables architects to design standing seam roofing, installed directly onto rigid insulation





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Metal in architecture supplement

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september 2014

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features

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Editor's letter

Following the successful launch of Architects' Datafile's supplements, with our first edition dedicated to glass and translucent materials, I am delighted to welcome you to this, our second special supplement, entitled Metal in Architecture.

As metals play a vital role in both the structural and aesthetical aspects of architecture, we are taking a close look at different metals and the diversity of their application, along with some of the latest news from the industry.

We are extremely pleased to include in-depth editorial contributions from the Council for Aluminium in Building (CAB), the British Stainless Steel Association (BSSA) and the Galvanizers Association.

Technological developments, sustainability, environmental considerations, finishes, processes, new forms and new ways of using some of our oldest building materials are just some of the subjects that we examine in detail and which are discussed by a variety of experts in their field.

We also showcase projects that use metal in inspirational ways, while journalist Steve Menary reports for us on how the use of metal is changing in major sport, leisure and retail projects.

For every architect, I hope this is a compelling read.

Sarah Johnson

Get your free copy of VMZINC's 320-page hardback book of zinc facades and roofing projects from throughout the world – free only to readers of ADF

With zinc having become so popular in the UK as a facade, roofing and rainscreen material, projects in which it has been used are both diverse and widespread. In acknowledgement of the way architects have used systems and colours to create distinctive features of the building envelope, VMZINC has published a 320-page hardback book of professionally taken project photography. Entitled *From Z to A*, the book contains images of some of the world's most stylish, contemporary buildings. Sectors covered include: Education; Transport; Health; Leisure; Financial; Commercial/Retail; Municipal; Ecclesiastical; and Residential – private and public sector. Among the most striking buildings are several theatres and arts buildings and that of Umicore, VMZINC's parent company. Its office building in Hoboken, Belgium shows how zinc can be used to striking effect in a series of curved planes linking floors. Products featured range from traditional standing seam to interlocking and flatlock panel, cassettes and shingles in pre-weathered QUARTZ-ZINC® and ANTHRA-ZINC® and PIGMENTO® red, blue and green. With PIGMENTO brown having also been introduced in 2014, the design scope that VMZINC systems provide is now more extensive than ever, supported by a library of photography of hundreds more projects throughout the world.

Social media garden is first step in creating 'emotional' buildings

A Twitter-reactive garden could provide a prototype for the future development of 'smart' buildings that can adapt to our emotional state

A Twitter-reactive garden could provide a prototype for the future development of 'smart' buildings that can adapt to our emotional state.

The structure has been created by academics from the University of Lincoln, UK, taking its inspiration from the University's Digital Capabilities garden, which won Gold at the RHS Chelsea Flower Show 2013. The STAN (Science Technology Architecture Networks) research project, which involves computer scientists and architects, is exploring whether architecture is able to reflect and map human emotions.

The garden consists of an articulating raw steel structure, which sits vertically and horizontally, and is controlled by people's responses via Twitter. In this way it is continuously revealing what the landscape is covering, while also remodelling itself.

The garden reacts to activity on Twitter when people use the **#gardenup** hashtag, translating this information into movements of the garden's mechanical landscape.

Richard M Wright, senior lecturer in the Lincoln School of Architecture, developed the construct together with fellow academic Barbara Griffin and students Amy Hayeselden, Nicholas Sharpe and Liam Bennett from the university's School of Architecture.

He said: "The garden essentially points to a future in which buildings could modify themselves in response to monitoring our emotional state via social media. For example, if we feel like wearing a big cosy jumper and sipping a cup of boiling hot soup, it will turn the temperature down and open a window. Buildings may also begin to reflect the mood of a populace by changing colour or shape, constantly remapping our perception of our urban environment, with facades becoming animated, reflective and mobile in response to communal desires and emotions.

"The fact we decided to retain the structure's raw metal appearance is a tangible reminder of Sheffield's industrial past, changing and weathering as a result of the environment."

Dr Duncan Rowland, a fine artist and reader in the School of Computer Science, developed the software application. He added: "We exist in a dynamic flux of social information; the software aims to intercept and expose some of this data in a tangible representation."

Construction steelwork makes its 3D printing premiere

Using the latest 3D printing techniques, or more accurately, 'additive manufacturing', the Arup team has produced a design method for critical structural steel elements for use in complex projects.

The work signals a whole new direction for the use of additive manufacturing in the field of construction and engineering. The research also shows that additive manufacturing has the potential to reduce costs, cut waste and slash the carbon footprint of the construction sector.

Arup created a redesign of a steel node for a lightweight structure using additive manufacturing. Arup has a lot of experience with these kind of structures, for example the tensegrity structure of the Kurilpa Bridge in Australia. The complex geometry of these kind of nodes are an ideal showcase of the possibilities of this new technique.

"By using additive manufacturing we can create lots of complex individually designed pieces far more efficiently. This has tremendous implications for reducing costs and cutting waste. But most importantly, this approach potentially enables a very sophisticated design, without the need to simplify the design in a later stage to lower costs."

Salomé Galjaard, team leader, Arup: "Arup funded the development work and collaborated with a number of partners to realise the designs, including WithinLab (an engineering design software and consulting company), CRDM/3D Systems (the Additive Manufacturing partner) and EOS, who worked on the early development of the technology."

Before

After

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1 The Right Products

Don't rely on a single manufacturer who will recommend their product for any application. Get independent support from an experienced supplier: make an informed choice.

2 Design Expertise

Don't risk uncoordinated design input from several manufacturers. Have your roof designed, specified and co-ordinated from the deck up by a single PI insured designer.

3 Meet the Regulations

Ensure you meet all the Statutory Requirements even if they change. Use an independent, expert design service and get full, free technical support until completion.

4 Confidence in Supply

A reliable supply chain is essential for profitability and performance. Choose a proven supplier who can cut waste and cost, supplying only what you need.

5 Experienced Contractors

An experienced, accredited contractor knows the products and will integrate the roof system with your whole building so it performs well and looks great too.

6 Monitored Installation

In many projects, buildability issues will crop up on site. Ensure your supplier will monitor the installation and provide quality field support for your contractors.

7 Full Guarantees

Don't fall between suppliers who may dispute responsibility. Have the roof designed, installed and guaranteed from the deck up by a single entity you can rely upon.

8 Planned Maintenance

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A benchmark headquarters campus

Located within the striking setting of the Grand Union Canal, Imagination Technologies' new Headquarters is the first building to be completed in a three phase masterplan, which begins to realise EPR Architects' vision for the creation of a coherent and revitalised office campus. The state-of-the-art accommodation provides a working environment that an evolving company at the forefront of research and technology requires in order to attract the best staff and clients alike

The completed Phase 1 building known as Imagination House provides flagship office accommodation over three floors situated to the North of the campus. The building is a double storey extruded form, floating over single storey transparent lower ground floor fronting onto Grand Union Canal. Both ends of the form are transparent to create a sense of openness and sculpted to work within their unique setting

Internally, the one storey level change across the site enabled a floor below the entrance level where there are amenity facilities for the entire campus. Located partly within the base of the central atrium, at the building's heart, the campus cafeteria and associated break out space provides a strong sense of vibrancy and animation, a focal point for staff to come together, relax, socialise and congregate in a space which offers stunning views of the Grand Union Canal. An external space of the cafeteria provides private amenity space adjacent to the canal for everyday staff use, as well as being suitable for entertaining clients, communal office events and formal staff gatherings.

A feature staircase located within the atrium connects the reception area with office space above and the cafeteria space below. The stair not only communicates and draws together the three distinct areas of the building but also provides movement and activity that further enriches the sense of vibrancy provided by the atrium.

The Phase 2 design includes the re-landscaping of the canal spur corridor to provide high quality waterside amenity space for staff. The inclusion of a new footbridge spanning the canal race, which effectively bisects the site, connects the 'island site' of the phase 2 building with the other phases, allowing direct access between all three buildings so to function as a coherent campus with a common identity.

The design of the footbridge reflects and brings together in harmony the diverse and opposing nature of the site and its surroundings. A glass balustrade on the campus side representing the hard edged, mechanical nature of the modern office buildings and timber on the other, making reference to the softer, natural setting of the Grand Union Canal and the countryside beyond.

Phase 1 project team

Architect: EPR Architects

Client: Imagination Technologies

Structural engineer: Evolve

M&E engineer: AECOM

Planning consultant: Indigo Planning Ltd

Cost consultant: Heasmans

Transport: Savell, Bird & Axon

Flood risk: McCloy Consulting

Landscaping: Neil Tulley Associates

Ecologist: AA Environmental

Archaeology: Wessex Archaeology

Project manager: Patrick Gill Consultants

Contractor: Miller Construction

Metal comes to the fore in public-facing projects

Steve Menary explores the changing use of metal in major public-facing projects from sports to leisure and retail

Most of the sports fans in the Chris Hoy Velodrome at this year's Commonwealth Games in Glasgow would have been gripped by events on the track. Had they chosen to glance upwards, they would have seen an intricate roof design that was not only structurally essential but also added to the visual appeal of the building.

Designed by 3D Reid, this sort of steel fabrication is becoming more commonplace in the construction of major public-facing projects as designs move away from the simply structural towards an attempt to blend the utilitarian with the greater aesthetic. Sports stadia in particular has seen an improvement away from the traditionally grungy concrete and steel bowls that, in the UK at least, typified the experience of sports fans prior to the publication of the Taylor Report in 1990.

Two major landmarks in this improvement in design were the redevelopment of Wembley Stadium, with its iconic new metal roof, and the Bird's Nest Stadium, built for the 2008 Olympics in Beijing, where the envelope and the structure became one. The architect on the Wembley scheme was Populous and the practice has gone on to take a radical new approach to the specification of metal in projects since then from the London 2012 Olympic Stadium to the proposed new GAA Athletic Stadium in Belfast, where a steel-fabricated roof will also be used.

Populous Principal Architect Philip Johnson says: "We normally look at the form and how the different levels fit together and the performance requirements. That leads onto choice of materials. It's often steel that's specified due to its strength and weight.

"The roof design is often the defining feature [of a stadium] so you are very aware of how it will appear on the skyline. We looked at many different options of how the London Olympic Stadium would look and in particular the lighting. We used a combination of tubular steel and steel cables to great effect that made the lighting towers look very delicate."

Populous has also used stainless steel to great effect outside of the roof on other areas where the project's interaction with the public is vital, such as the stainless steel staircases that the practice specified at Ascot Racecourse back in 2006.

Continued overleaf...

'It's often steel that's specified due to its strength and weight'

Philip Johnson, principal architect, Populous

© Populous

Belfast GAA Stadium

'Inspired by the local context with the bronze and copper specified to pick up on existing bronze sculptures'

Different metals have also been specified to produce an innovative aesthetic at other stadia projects. A good example can be found on the other side of the world to London at the Adelaide Oval in Australia, where bronze cladding and copper mesh were specified. The aim here, according to Mee Kyong Kim of architects Walterbrooke, which worked on the project with Cox Architecture and Hames Sharley, was to add an extra dimension of material quality to the sports stadia typology on the redevelopment of an iconic Australian sports venue.

The palette of facade materials includes sandstone coloured concrete, glass, bronze and copper and was inspired by the local context with the bronze and copper specified to pick up on existing bronze sculptures. The bronze and copper facades from Aurubis will also gradually weather to a dark reddish brown colour that should sit comfortably within the park landscape.

Adalaide Oval

Ms Kyong Kim explains: "The copper mesh wraps and meanders around the external facades and stairs as a gentle, curved veil along the radial grids. A series of solid bronze volumes protrude though the veil and curtain-walled envelope. Each one is oriented to optimise views to St Peter's Cathedral, the gardens, the riverbank and central area, from the dining rooms and members' bars. This material language is also applied to the internal atrium space."

At the Splashpoint Leisure Centre in Worthing, architects Wilkinson Eyre specified the use of copper in the construction to pick up on the proximity to the sea. The practice's design maximises the potential of the site with 'ribbons' of accommodation that flows from north to south with the intention of emphasising the connection between land and sea.

Each pool form has its own terrace and the dynamic, fragmented shape of the centre, including a saw-tooth roof with ranks of sinuous edges, is arranged to respond to the surrounding mix of built forms and landscape and reduce the visual mass.

The structure is clad in copper supplied by Aurubis and red cedar – a palette of self-finished natural materials selected to age gracefully in the maritime conditions. The facade integrates a series of substantial glazed panels, creating the effect of "picture frames" to the windows and roof lights.

A spokesperson for Wilkinson Eyre said: "Copper and timber are materials that are synonymous with the tradition

Splashpoint Leisure Centre (left); Hengrove Leisure Centre (below)

of English seaside culture. These materials are also robust against the fierce coastal elements, complement each other aesthetically and are sensitive to the history of this beautiful seaside town. Copper is a material that truly 'roots' itself to the site; the material metamorphoses from its traditional rich, reflective copper red through to the dull dark browns and further to a vibrant green patinated finish."

The specification of a metal cannot always be seen and often with that aim as demonstrated by the design at another award-winning leisure centre in Bristol. LA Architects specified aluminium curtain walling with the intention of the metal being 'invisible' at Hengrove Leisure Centre in Bristol.

Built by Kier and operated by Parkwood Leisure on behalf of the city council, the project is one of the first centres in the UK with a 50m swimming pool to achieve a BREEAM Excellent rating. LA Architects' design specified large sections of Technal curtain walling, which included a 50mm aluminium profile that was sufficiently robust to hold glass units, some of which spanned 2.75m by 2.2m.

The architects' aim was to create an 'invisible wall' allowing unobstructed views onto a landscaped central plaza inside. This created greater visibility from outside the pool and inside the centre and contributed to an award for community benefit from the Royal Institute of Chartered Surveyors.

Manolis Datseris, project architect at LA Architects, said: "We wanted to achieve a crisp, sharp edge to the curtain walling here and to create a building that is filled with light. Our aim was to bring the landscaped plaza inside the centre by having perimeter walls that are almost transparent, giving a greater feeling of space."

A decision by Arup to opt for aluminium on the Singapore Sports Hub was driven by the aesthetic it created and also the metal's weight. "The King's Hotel Indoor Arena was adjacent and that had a titanium roof and aluminium was important to have a continuous surface of reflective metal," explains Clive Lewis, an associate director at Arup, the architect and the engineer on the scheme.

The Singapore Sports Hub is the largest free-standing dome in the world and simply relying on steel would have been problematic structurally. Instead, using a unitised system of aluminium cladding that was assembled on the ground then put up in sections of around 45m by 6m using a crane allowed

Continued on page 15...

'Copper and timber are materials that are synonymous with the tradition of English seaside culture. These materials are also robust against the fierce coastal elements, complement each other aesthetically and are sensitive to the history of this beautiful seaside town'

Spokesperson for Wilkinson Eyre

Project: Dolomitenblick, Sesto, Italy; Architect: Plasma Studio; Photo: Hertha Hurnaus.

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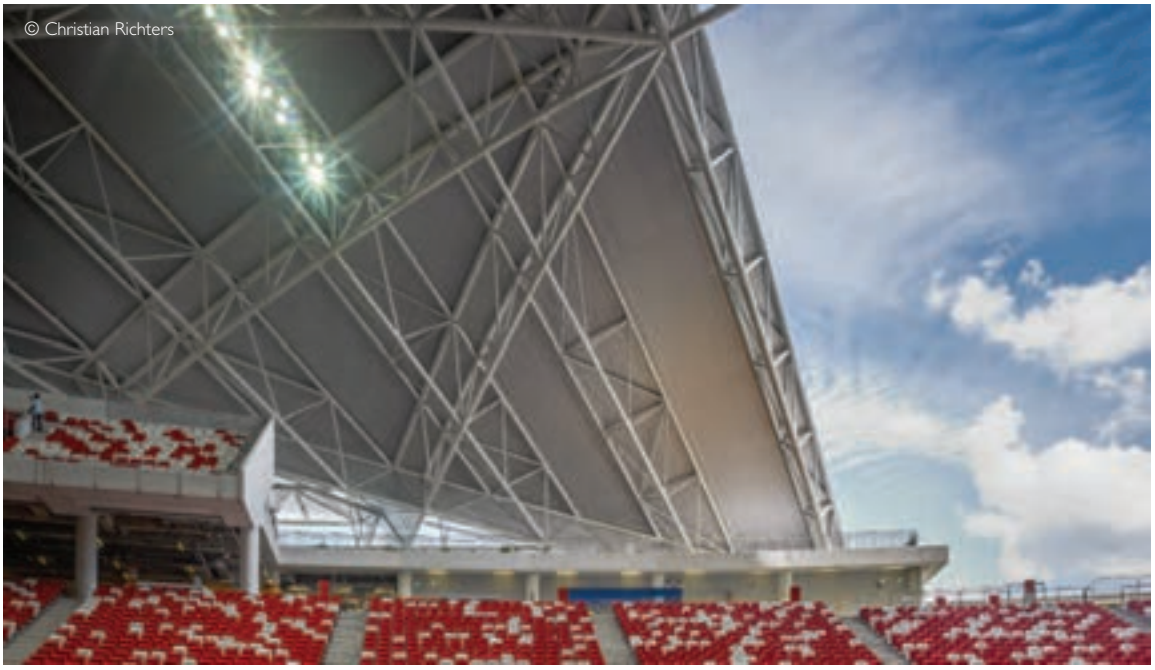


Singapore Sports Hub (left); London Designer Outlet (below)

Arup to dramatically cut the amount of steel needed.

Mr Lewis adds: "We used about a third of the amount of steel that would have been used. Everything about the structure was about cutting weight. With the cladding, we achieved 30 kg per sq m.

Singapore gets tropical rain with up to 70mm every three minutes in monsoon season. That means rain noise is also a big issue on roofs. On the hub, the use of aluminium also helped improve the acoustic performance of the roof.

Aluminium and steel were used to both create a distinctive impact and also help keep costs down on the London Designer Outlet. Built by John Sisk and designed by architect Leslie Jones, the scheme opened late last year and is located next door to the Wembley Arena in London.

James Cons, managing director of Leslie Jones, explains: "This wasn't just a designer outlet but also a leisure scheme with cinema and retail. There was a tight budget as rents are low compared to a retail-only scheme. We had to come up with our own elevation that was exciting and could also sit alongside Wembley Arena."

After a strategic decision further up the supply chain, power coated stainless steel with aluminium in the centre was specified. "The metal cladding offered us dynamism and the aluminium in the centre gave us highlights," adds Mr Cons. "The metal work also offered us a contrast to the brick plinths. We used composite aluminium panels from Kingspan to clad up the back of the parapets, which was a cost effective solution. The car park was also completely clad in aluminium fins of various forms."

The combination of steel and aluminium may be taken for granted by members of the public visiting the LDO, but not by a construction team working to a tight budget. However, for the public, the use of metal is also becoming more commonplace.

With so many increasingly innovative products being offered, metal has moved a long way from simply being a fundamental – but often unseen – part of the construction process to one that can create both a cost-effective and exciting solution in the design process.

'The metal cladding offered us dynamism and the aluminium in the centre gave us highlights'

James Cons, managing director of Leslie Jones

Metal in architecture showcase

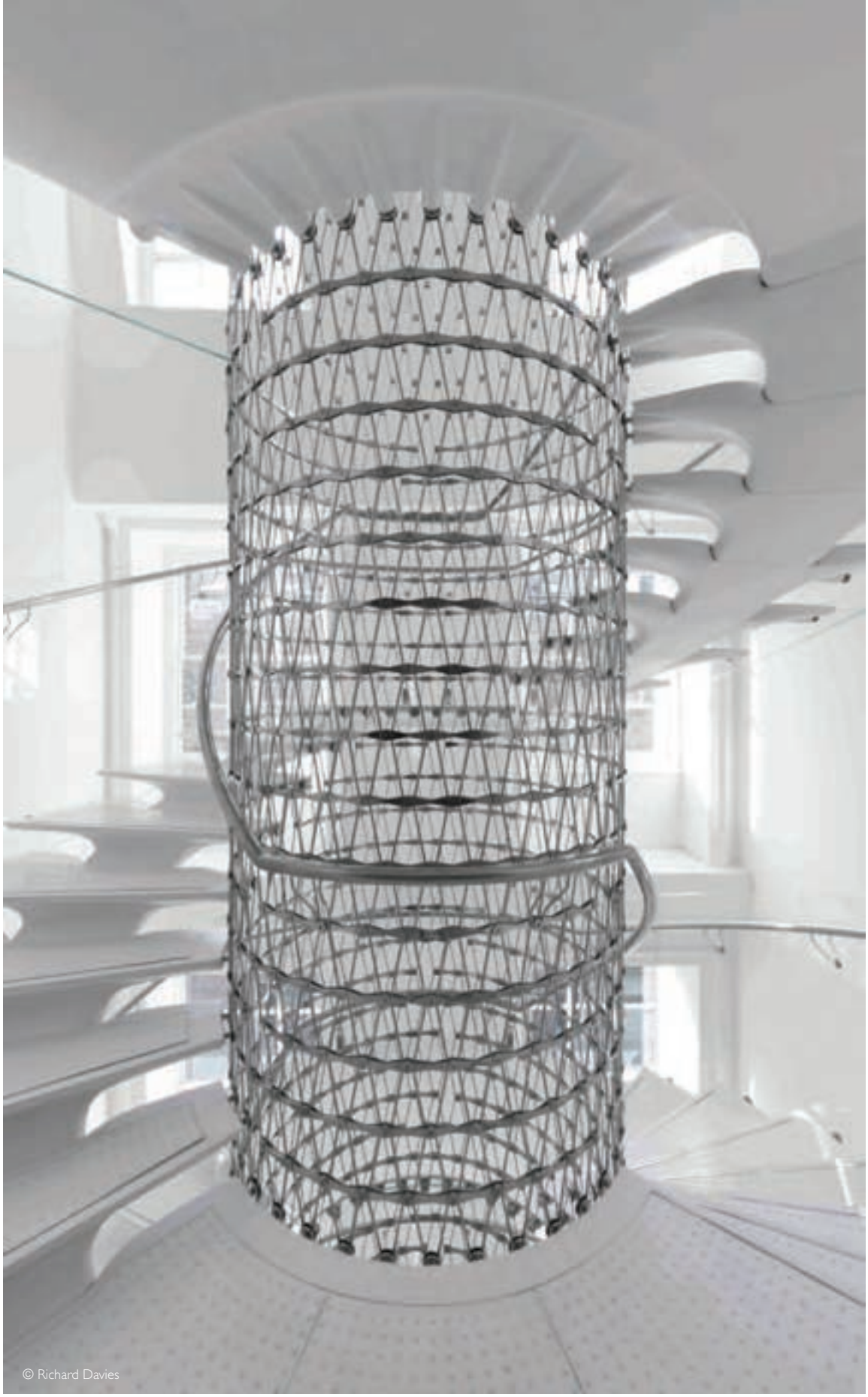
Foster + Partners has revealed designs for the sustainable new headquarters of RMK in Yekaterinburg, one of the world's leading producers of copper – the project rethinks the conventional cellular office to set new standards in quality, comfort and flexibility. The facade appears to subtly change according to the season and path of the sun – it is made up of triple-glazing and triangular bronze coloured steel panels, which are textured to create a subtle patina. Each 10 x 6m cladding unit spans a two-storey office module. Responding to Yekaterinburg's high temperature shift between seasons, the balance between solid and glazed areas is designed to maximise low level winter sun, while blocking the heat of direct sunlight during the summer. The triangulated form draws inspiration from the chemical structure of copper, and the top of the building integrates RMK's new logo – a rebranding which has, in turn, been inspired by the architecture.

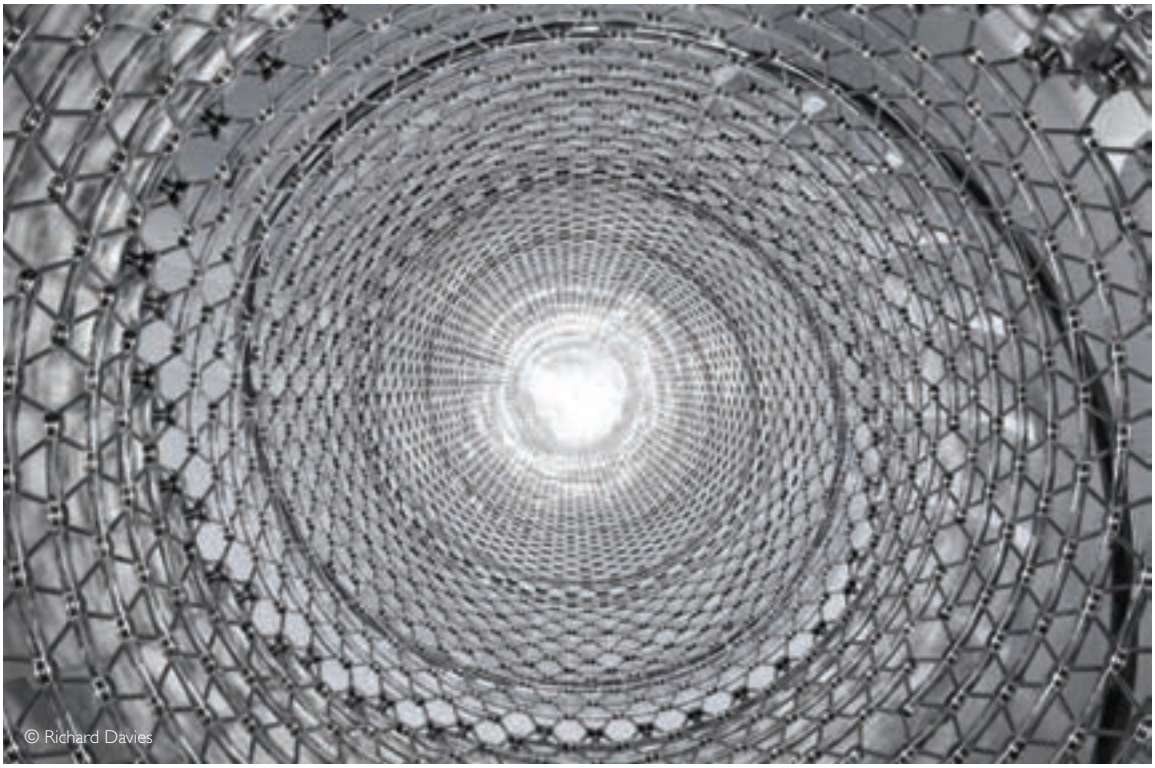
The refurbishment of a high-rise building at the Darmstadt University of Applied Sciences in Germany features a highly distinctive, award-winning bespoke facade solution from Wicona. The tower was completely stripped back to its original concrete structure, the windows were replaced and the outer walls were created with Wicona curtain walling. The north elevation features narrow strips of glazing and contrasts with the south elevation which has striking 3D metal facade elements for solar shading. The design was developed by Wicona in conjunction with fabricators Heinrich Würfel Metallbau GmbH and Co Betriebs KG.

3,000 sq m of perforated and embossed aluminium panels from RMIG have been fitted to the exterior and interior of the regional archives in Reims. The coated exterior cladding has a powerful visual impact, creating an optical illusion that helps the large cube-shaped building blend sympathetically into its surroundings. Depending on the weather and light, the colours and appearance of the perforated and embossed facade panels can transform from dark to sparkling, from opaque to transparent, from dull to glossy or from brown to golden, making them as diverse and multi-facetted as the historic archive itself.

Continued overleaf...

The Miles Staircase for Grade I Listed Somerset House was designed by Eva Jiricna Architects and incorporates treads of highly-engineered fibre reinforced concrete supported on a lattice of stainless steel. The four storey structure has 104 steps and landings fixed together with traditional shear keys modified to accommodate the high forces generated by the spiral form. Moulds were hand-made in northern Italy and the components were cast to close fit. The structural system is based on a conventional scissor stair with additional support from rod suspension systems. The stainless steel newel, manufactured in Newcastle, functions as a vibration damper. Steel supplier for the lattice was Clifford Chapman Metalworks. Structural engineer: Techniker.

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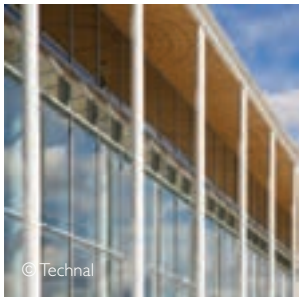
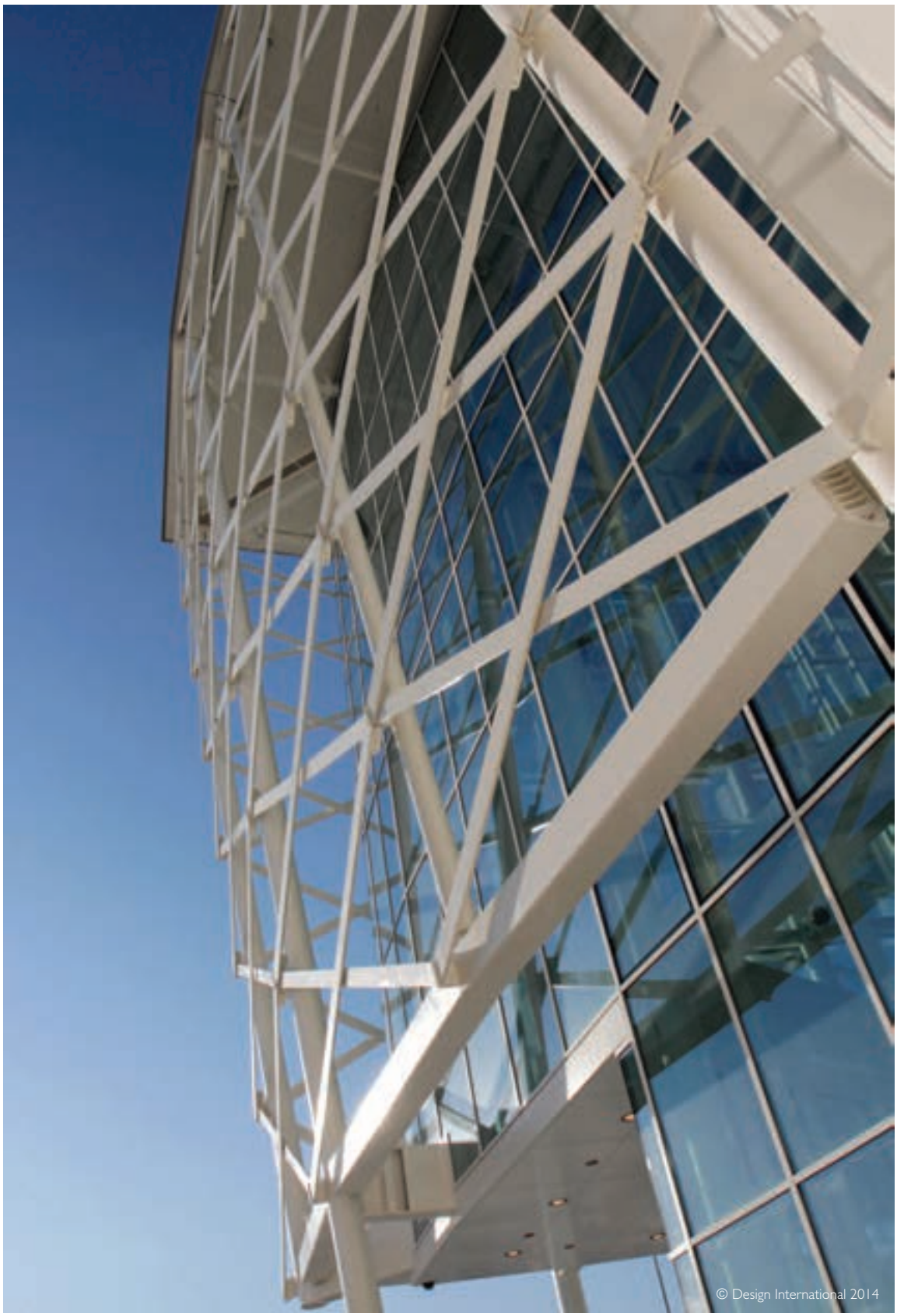

© Technal

A leisure centre in Bristol features extensive use of Technal's aluminium curtain walling. The architectural design of the scheme features large areas of Technal curtain walling to give the impression of 'invisible walls' – allowing unobstructed views from the interior looking out on to the landscaped central plaza. The glazed facades also provide high levels of natural light and a good night time appearance for the building. The slim 50mm profile of the GEODE-MX Visible Grid system met the architects' requirements for thin sections which were sufficiently robust to carry the heavy glass units, some of which are laminated and toughened, and span up to 2.75m by 2.2m.

Continued overleaf...

Considered already as an architectural landmark in Marghera, Venice, Nave de Vero is an ultra-modern shopping centre designed by architect Davide Padoa, CEO of Design International and his talented multidisciplinary team. 'La Nave' – the ship – makes up part of the complex's grand main entrance. The tall glass atrium, shaped as a ship and externally enclosed by a steel structure, dramatically emerges out of the building at an angle, welcoming its guests. Metals used include steel and aluminium. The images show a steel lattice; curtain wall system aluminium; a tubular steel structure; a curtain wall system made of aluminium and an enamelled steel soffit.



A Twitter-reactive garden could provide a prototype for the future development of 'smart' buildings that can adapt to our emotional state. The structure has been created by academics from the University of Lincoln, UK, taking its inspiration from the University's Digital Capabilities garden. The STAN (Science Technology Architecture Networks) research project, which involves computer scientists and architects, is exploring whether architecture is able to reflect and map human emotions. The garden consists of an articulating raw steel structure, which sits vertically and horizontally, and is controlled by people's responses via Twitter. In this way it is continuously revealing what the landscape is covering, while also remodelling itself.


Courtesy of Proteus Engineered Facades

A stunning mirror-finish skin of stainless steel is helping to protect the new Broadway Malyan designed purpose-built home of the M&S Company Archive at the University of Leeds. It features extensive use of Proteus Engineered Facades' HR rainscreen cladding system which combines all the benefits of a Modern Method of Construction with the beauty of "bronze". The £6 million Michael Marks Building on the university's Western Campus follows the golden rule of architectural design "Form follows function", combining within the facade the high strength, low maintenance and excellent corrosion resistance of stainless steel with a visually contemporary finish.

Continued overleaf...

The new Chatham Waterfront bus station provides the perfect example of how zinc is the ideal metal for tight curves and complex detailing. VMZINC standing seam canopies and flat lock fascias in pre-weathered QUARTZ-ZINC® were specified by infrastructure specialist D5 Architects.

Leslie Jones Architecture chose brass to clad their dramatic geodesic entrance arch at The Moor Market in Sheffield. The beauty and gradual weathering properties of this material naturally complement the exposed timber structure while the arrangement of panels of interlocking triangular shingles expresses the structural geometry of the arch.

Glasgow's new 25,000 sq m entertainment destination, SSE Hydro recently won Gold and the 'Best of Best' award at the AIS (Association of Interior Specialists) Annual Contractors awards 2014. Foster + Partners specified SAS International's architectural metalwork and acoustic solutions for the 12,500 capacity auditorium bowl. SAS International worked in collaboration with Foster + Partners on the striking ceiling design, answering the brief for an aesthetic solution which provided acoustic control. SAS International supplied over 600 sq m of its suspended ceiling System 330 for the project and over 900 sq m of architectural metalwork solutions including tubeline and baffles.

Some 1,800 sq m of NedZink Nova was used to create a Proteus HR facade panel system at Imperial Tobacco in Bristol, designed by AWW Inspired Environments

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Stainless steel in architecture – versatility and utility

Alan Harrison, technical advisor for the British Stainless Steel Association, explains why the use of stainless steel is so varied in architectural applications

Since its invention in 1913, stainless steel has been used in a wide variety of architectural applications, stretching back to New York's famous Chrysler Building in 1929 and taking in iconic projects such as London's Lloyd's Building and Canary Wharf. Some of these applications are obvious such as cladding, roofing, handrails and balustrading, and rainwater goods, whereas others, such as stainless steel building support products and reinforcing bars, are not.

In all of these applications the dominant properties are durability, aesthetic appearance, mechanical strength and ease of fabrication. The first two of these derive from the self-healing, passive, chromium-rich oxide film, which protects the steel surface from all but the most aggressive environments. The second two derive from the metallurgical structure, which arises from the carefully controlled chemical composition and manufacturing process route.

The choice of grade and surface finish, plus good design and fabrication practice, ensure that stainless steel meets the demanding expectations of architects.

What is stainless steel?

Essentially, stainless steel is a steel with a minimum of 10.5 per cent chromium. In practice, for architectural applications, the chromium content is usually higher at about 18 per cent and often contains elements such as nickel and molybdenum for improved fabrication and corrosion resistance. The two most common grades in the architectural sector are 304 (EN 1.4301) and 316 (EN 1.4401). However, newer grades are finding a role. For example, the increased strength of duplex grades leads to a benefit in thickness and weight reduction and some ferritic grades can match the corrosion resistance of 304 and 316 while being somewhat cheaper due to the absence of nickel.

The grade of stainless steel can therefore be matched to the structural properties required and the environmental conditions it will have to withstand. These range from benign internal and rural atmospheres to severe marine atmospheric or urban environments.

Aesthetics

Stainless steel can be supplied in a wide range of surface finishes, depending on the effect that the architect wants to achieve. At one end of the spectrum is a mirror polished or bright annealed surface: an approach exemplified by the Bristol Planetarium, which reflects the sky and streetscape in its spherical structure.

For where the architect requires a more subdued approach, brushed, bead blasted or patterned stainless steel surfaces can be chosen. It is even possible to mimic a bead blasted surface by rolling it on at the steel mill, as in the award winning BDP Building in Manchester. The insulated stainless steel panels on the south side of the building help to achieve the Excellent BREEAM environmental rating.

Continued on page 27...

'The dominant properties are durability, aesthetic appearance, mechanical strength and ease of fabrication'

The addition of a wide range of coloured stainless steel is also providing architects with greater design options. Colouring can be achieved using chemical, electrochemical and physical vapour deposition (PVD) processes. A striking example is the Wales Millennium Centre in Cardiff.

Structural

In many cases, stainless steel works behind the scenes where specialised brick, masonry and concrete supporting products are typical of this sector. Few people outside the industry would recognise the contribution of the 1,000 special stainless steel wall ties to the striking brick facade at St Pancras Station.

However, sometimes aesthetic and structural properties come together in buildings, such as the recently extended Whitworth Gallery in Manchester. In this case, bright polished 304L stainless steel columns were used as internal structural elements in the gallery space. They act both as essential structural elements and to reflect the surrounding park environment. Even before the official reopening in October 2014, the project has drawn favourable comments from many sources.

The use of stainless steel for reinforcing bars is a small but vital part of this sector. This is particularly true for coastal applications or where run off from road salt produces an aggressive environment where normal carbon steel reinforcement is vulnerable. Stainless steel reinforcement is also used in specialised buildings such as an MRI scanner suite where the non-magnetic nature of austenitic stainless steel is required for non-interference with the MRI technology.

Design

Like all materials, good design principles need to be followed to ensure optimum performance. For stainless steel this includes clean flowing lines avoiding places where rainwater can accumulate, maximum natural rainwater washing especially at coastal locations, access allowance for maintenance and cleaning, and understanding the technical requirements of specific environments, for example, swimming pools.

Simply stunning

Occasionally, very little needs to be said because the building says it all. An example of this is the King Abdulaziz Cultural Centre at Dhahran Saudi Arabia, due for completion in 2015. This uses stainless steel to produce a magnificent structure which is also capable of meeting the LEED environmental standard.

Summary

Stainless steel provides a versatile material to meet the most demanding environments. It is a material well able to fulfil the dreams and aspirations of the most visionary of architects.

'The addition of a wide range of coloured stainless steel is also providing architects with greater design options'

Stainless steel green wall systems are a fast growing solution

While still a relatively new concept for specifiers in the UK to consider, the use of green walls as a sustainable building solution continues to grow rapidly, with a wide range of aesthetic, thermal, environmental and cost benefits on offer to architects, building owners and facilities managers. By Justin Errington, director of MMA Architectural Systems Ltd

'While these systems are not installed with full plant coverage, well designed systems provide elegant aesthetics from the time of first installation – even before the planting scheme has fully matured'

Over the last two decades, a range of modern systems and techniques have been developed which provide the aesthetic appeal of a green facade while enhancing a building's operational performance. Modular compost and hydroponic systems are two such options, both of which have been used in a number of projects to provide an 'instant' green wall.

However, an excellent alternative to these heavier and more costly modular systems is the use of lightweight stainless steel systems, which not only deliver comparable long-term benefits, but are also much more cost effective and provide some unique, material advantages.

These systems use a combination of high grade stainless steel wire ropes, rods and mesh products to provide a robust, elegant and long-lasting structure that supports plant growth on building facades. The use of marine-grade stainless steel also gives assured quality for the life of a building (making the systems suitable for even the harshest environments, including coastal applications) and their light weight makes them easy and fast to install – and immediately able to support new plants which are planted on-site (typically for a square metre of fully-established plant coverage, a stainless steel system weighs only 20-30kg when planted).

Conventionally, plants are grown up green wall systems, but given the requirements of individual projects, they may also be planted to cascade down the structure (i.e. grown from the top down), or from planters installed at strategic points up the facade. Routine horticultural maintenance is necessary to maximise the life of the wall and to realise its full potential, but whether grown from the top or bottom, maintenance is simple and straightforward and is carried out predominantly at planter level. If necessary, plant replacement is also a simple task.

Through the use of these products in combination, architects can achieve a wide variety of designs on the vast majority of building structures, including curves and intricate shapes to meet their overall design objectives. Well designed and well maintained green walls significantly enhance a building's appearance – whether it's to add a new aesthetic dimension, disguise a car park, refresh a tired facade or add colour and texture to a wall.

Used on appropriate elevations (and suppliers of these systems are generally very happy to work with architects at every stage of the process to ensure that the right system is specified to meet their needs) green walls can deliver a number of significant operational advantages.

They can certainly help to improve energy efficiency and reduce energy costs by providing an additional layer of insulation in the winter and acting as a screen to the sun in the summer. Acting as an insulation layer in this way not only delivers thermal benefits, but also acoustic ones, with green walls able to absorb sound and so improve the living and working environment of the building's occupants and their local environment.

In urban areas, the structures help to improve local air quality by absorbing carbon dioxide, trapping dust and other harmful pollutants such as PM10 and releasing oxygen. If graffiti is a particular local problem, green walls can provide an excellent

deterrent, making the application of graffiti directly to the building structure almost impossible. The introduction of plants to the local environment also provides an ideal habitat for new or displaced wildlife, improving bio-diversity by providing new habitats for birds, bugs, bees and flora. If required most manufacturers can advise on the optimum planting scheme and also help with the introduction of appropriate flora and fauna.

The walls also help to protect the facade of a building, extending its life by acting as an effective shield to weather and helping to protect it from damaging UV light.

Stainless steel green wall systems not only offer these sustainability benefits, but are also energy efficient in production, accounting for very little embodied energy per square metre of building. The system, unlike some others, is also completely recyclable at the end of its useful life.

While these systems are not installed with full plant coverage, well designed systems provide elegant aesthetics from the time of first installation – even before the planting scheme has fully matured. With careful design, the materials used in combinations provide an array of design options, offering the addition of texture and geometric patterns to a building's facades and providing interesting shadow definition. And while the plants are maturing, these systems can provide an interesting aesthetic structure allowing the building's occupants and their neighbours the chance to see the wall evolve and fully develop.

SIG Zinc & Copper detects metal renaissance

Growing numbers of architects are choosing metal for roofs and cladding not only because of its undoubted green credentials and lustrous good looks but also because the use of the material has evolved stylistically.
By Simon Walker, category manager for SIG Zinc & Copper

Imperial Tobacco in Bristol, designed by AWW inspired environments (above); SIG Zinc & Copper's bespoke de-coiler (opposite top); brick and zinc are always an aesthetic success. Building designed by AWW inspired environments (opposite bottom)

Gone are the days when metal made an appearance only on barns, farm sheds and other rural buildings. Recent trends show it is migrating away from the countryside and bringing its distinctive aesthetic qualities back to the urban environment, reminding us in the process of metal's long heritage, especially on roofs, as an architectural statement.

Beyond delivering a dramatic visual impact with zinc, copper and stainless steel, the materials are proving popular with architects for a whole raft of reasons, not least their versatility and the way they can convey the design ideas that inform an entire building.

Thanks to their natural patina formation, they offer a long lifespan. They are also largely maintenance-free and 100 per cent recyclable, so they can contribute to high BREEAM ratings.

Zinc has many of the characteristics architects love. It can be used on the entire building envelope and loves to follow curves and angles. Whether used on the roof or for cladding, it always looks splendid and its crisp lines accentuate shape and design features. There is also no need to rely on time to create a good patina on zinc; a range of finishes is now available, including pre-patinated, matt and textured, as well as colour options.

This increasingly popular metal – the 24th most abundant

resource in the world's crust at 75 parts per million in mass – is tough, seriously tough. Weatherproof, corrosion resistant and not degraded by ultra violet light, it can last up to 100 years without degradation, and there are many examples in Northern Europe that have exceeded that timeline.

The long life of zinc makes it a cost effective choice when considering whole life options. But zinc can also be cheaper. Currently, it compares well with alternative metals such as copper, lead and stainless steel.

Copper's warm colouring lends any building a certain elegance, and there are many centuries-old green copper roofs still standing as testimony to its longevity. Its resistance to the elements is one of the reasons copper ranks among the most desirable of modern roofing materials. It is also much appreciated for its ease of formation, even over irregular structures and shapes, and for its compatibility with other materials. It is a material that adapts to many architectural styles.

'The long life of zinc makes it a cost effective choice when considering whole life options.'

As with zinc and copper, stainless steel scores well in the durability and low maintenance departments. It also offers truly dramatic visual impact. This is achieved not just through its own intrinsic and striking good looks as a material but because its use allows greater design freedom – it can span greater distances than other materials.

Hard metals offer the designer and specifier a wide palette of options. However, some issues need to be explored before they are specified. Firstly, initial costs are expensive but this can be offset by the longevity of the product and by eliminating waste by choosing a supplier who can offer bespoke quantities of materials. Secondly, there can be compatibility issues; this is why the technical guidance of an experienced supplier must be sought. And lastly there are limited design standards.

While metal roofing and cladding is certainly enjoying a renaissance, the wide range of market offers launched to meet demand for these in vogue materials has resulted in a certain level of confusion among specifiers. Much of this focuses on varying product quality, different detailing options and conflicting advice on finish and construction method from manufacturers.

The number one route to demystifying the specification of hard metals in architecture is choosing a supplier or manufacturer with comprehensive technical support. The supplier should be able to provide technical information, including bespoke details, NBS Specifications, 3D build-up and a warranty. Of course they will be able to offer advice on which products to use but, more importantly, they must also be able to advise when those products are not suitable for a particular project or application. A full, impartial design and supply service is the launch pad for success when specifying metal materials for any building design.

Notes from the Comar design team...

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Aluminium sustainability within the building industry

Justin Ratcliffe, chief executive at the Council for Aluminium in Building (CAB), reviews issues surrounding aluminium recycling and sustainability and highlights a number of projects undertaken by CAB and other leading International organisations who CAB partner with, including the International Aluminium Institute (IAI) and the European Aluminium Association (EAA)

Aluminium for future generations (AFFG)

The global nature of the aluminium value chain means that fostering sustainability within the aluminium industry and its products requires international collaboration. The key organisations involved in the work include the Council for Aluminium in Building (CAB), the European Aluminium Association (EAA) and the International Aluminium Institute (IAI). In order to manage environmental impacts, there is a need to measure and report them accurately. Hence the IAI produces an annual global sustainability report and five-yearly life cycle inventory report, detailing latest performance data. At the regional level, the EAA has produced its latest *Environmental Profile Report*: **http://www.alueurope.eu/wpcontent/uploads/2011/08/EAA_Environmental_profile_report-May081.pdf** which presents the development of robust European Life Cycle Inventory (LCI) datasets for the production of primary and recycled aluminium ingots and for the transformation of aluminium ingots into semi-finished products, i.e. sheet, foil and extruded products. Further development of global and European LCI data for aluminium and their use in accessible and transparent Life Cycle Assessment (LCA) modelling is a priority for this sector.

Aluminium's generic environmental profiles were updated in the BRE Green Guide online on 8 August 2012. For the first time since the introduction of the Green Guide, aluminium powder coated windows can now achieve the following ratings:

- 'A+' Rating (for all commercial windows < 0.9kg/m)
- 'A' Rating (for all commercial windows < 1.5kg/m)
- 'A' Rating (for all domestic windows < 1.08kg/m)
- 'B' Rating (for all domestic windows >1.08kg/m)

The aluminium industry, through the IAI in conjunction with leading associations, including CAB, has established a number of sustainability objectives (including energy and greenhouse gas emissions reduction), summarised in the table below:

'Fostering sustainability within the aluminium industry and its products requires international collaboration'

Aluminium sector existing sustainable development objectives and initiatives

Impact	IAI Existing Objectives	Recent Performance
Energy used in raw material production	10% reduction in energy use per tonne of alumina by 2020, from 2006	8% reduction, 2006–2011
Other impacts of raw material	Elimination of perfluorocarbon (PFC) in the long term; 50% per tonne reduction on 2006 baseline by 2020	25% reduction, 2006–2011 2013 Anode Effect Survey: **http://www.world-aluminium.org/media/filer_public/2014/08/08/2013_anode_effect_survey_report_2014.pdf**
	Increase the proportion of bauxitemining land rehabilitated annually	Annual rehabilitation area of existing bauxite mining areas is equal to the average annual area being opened up. In this steady state environment, bauxite mining is 'land area footprint neutral' and sustainable. 4th Sustainable Bauxite Mining Report. The Aluminium Story: Bauxite & Alumina: **http://bauxite.world-aluminium.org**
End of life impacts	Report regularly on global recycling performance	11 million tonnes recovered globally from used products in 2011. The Aluminium Story: Recycling: **http://recycling.world-aluminium.org**
	Recycling of aluminium cans to reach 75% by 2015	73% recycling rate reached globally by 2011: http://packaging.world-aluminium.org The Aluminium Story: Packaging: **http://packaging.world-aluminium.org**

Continued overleaf...

Progress relating to the objectives is reported annually by the global industry, including China (which represents over 40 per cent of aluminium production), and is disseminated widely.

'Recycling aluminium requires only 5 per cent of the energy needed to produce aluminium from bauxite, which means it has a high value as a recyclate'

Almost 1 billion tonnes of aluminium have been produced since 1888. Around 75 per cent of all aluminium produced since then is still in productive use as a result of high recycling rates (between 92 and 98 per cent for architectural aluminium; see **http://greenbuilding.world-aluminium.org**) and the long lifetime of aluminium products, particularly in the building and construction sector. Recycling aluminium requires only 5 per cent of the energy needed to produce aluminium from bauxite, which means it has a high value as a recyclate. This high value should ensure that similarly high recycling rates are maintained in the future.

Durability and service life of windows

CAB has sponsored two case studies on *Aluminium and Durability* by the Department of Architecture & Built Environment at Nottingham University in order to better understand and quantify aluminium's life expectancy in buildings. The work with the university also included sponsorship of the *Prototyping Architecture* exhibition at the Building Centre, London during Q1, 2013. CAB continues to highlight aluminium's longevity; for example, over 200 windows installed 73 years ago in the New University Library at Oxford University: **http://www.c-a-b.org.uk/why-aluminium/aluminium-longevity**

Responsible sourcing scheme for aluminium

The Aluminium Stewardship Initiative (ASI), launched in 2012, has been spearheaded by several industry players with the support of the International Union for Conservation of Nature (IUCN). ASI's first goal is to develop the ASI Standard to foster responsible resource management of aluminium through the entire value chain. The standard will define principles and performance criteria in the area of governance, environmental and social practices. It will be applicable for all stages of aluminium production and transformation, specifically bauxite mining, alumina refinery, primary aluminium production, semi fabrication (rolling, extrusion, forging, and foundry) as well as refining and remelting of recycled scrap. It will also include a chain of custody mechanism to allow a coherent and integrated linkage of information between the different stages of the value chain. It is forecast that the standard will be developed by the end of 2014; see **www.aluminium-stewardship.org**

CAB
Council for Aluminium in Building

For further information on CAB and its activities go to www.c-a-b.org.uk or contact the office on 01453 828851

Refurbishment projects using aluminium window, door and curtain walling

Eddie Robinson, managing director of Smart Architectural Aluminium looks at the use of aluminium door, window and curtain walling systems when specifying for a refurbishment project

The use of aluminium in construction projects has grown to such an extent that it is now the second most widely specified metal in buildings after steel. Used in a wide range of projects, across both the public and private sectors and from residential to commercial schemes, around 40 per cent of all the 375,000 tonnes of aluminium produced in the UK goes in to the building sector.

This rapid rise has been on the back of a range of intrinsic properties and advantages: it is manufactured from alloys that are corrosion-resistant; weather-proof and resistant to harmful UV rays; as a building material aluminium delivers robust performance over a long period of time, with very limited maintenance requirements. Widely acclaimed for its aesthetic properties, aluminium is one of the most durable and flexible building materials, yet its impressive sustainability credentials are much less well recognised, despite the fact that over two-thirds of all the aluminium ever produced is still in use today – the majority of it having been recycled or reused at the end of its useful life.

While always a key material for the new build sector, recent years have brought a significant growth in the use of aluminium systems in refurbishment projects, with manufacturers regularly developing and introducing new products and systems to meet the specific needs of these often sensitive applications. The majority of aluminium products used in heritage and refurbishment projects are window and door systems, with the architect and planner often requiring a closely matched aesthetic to the systems being replaced (very often, these are traditional steel units with their recognisable slim sight lines and art-deco appearance).

With an exceptionally high strength-to-weight ratio, aluminium is the ideal modern alternative for such applications, with both window and door systems available to provide the narrow frames necessary to meet these aesthetic requirements.

Not only can these systems match the slim profiles and lines of traditional steel doors and windows, but they can also provide significant performance advantages, combining elegant aesthetics with outstanding thermal performance. With slim, thermally-broken profiles, windows are available in a number of formats, including fixed-pane, sash and casement options, to provide the architect, building owner and facilities manager with great flexibility in terms of both design and ongoing operation. The benefits of working with a modern material also means that additional features can be provided; for example a wide range of door furniture and locking options are available, with many

Continued overleaf...

'Not only can these systems match the slim profiles and lines of traditional steel doors and windows, but they can also provide significant performance advantages, combining elegant aesthetics with outstanding thermal performance'

of the security features able to be concealed within the system's frame – making for cleaner, more elegant sight lines.

One recent project to have benefitted from the use of aluminium systems is the Royal Mail's landmark Mount Pleasant sorting office in central London, which has recently undergone a major modernisation programme. This has seen all the old uPVC windows in the main administration building replaced with new aluminium windows and doors, these products having been selected to bring back the aesthetic appeal of the building's original fenestration. The building originally featured large bronze windows, but in a 1980s refurbishment, these were replaced with white uPVC units.

The scheme's architect, Boyes Rees, wanted to reintroduce the distinctive, slim sight lines and bronze appearance of the original windows, features that had been lost through the use of uPVC, and so specified aluminium windows for the exterior facades. Each of the window units is an impressive 8m wide by 4.5m high and was manufactured in a dual colour format, with the external profile featuring a bronze polyester paint finish and the internal profile standard white.

Given the exceptional scale of each window unit, and their corresponding performance requirement, a bespoke, 85mm coupling mullion had to be developed to reinforce and strengthen the system, while retaining its characteristic slim profile.

Systems manufacturers not only invest in product development, but also in the introduction of a broad range of surface

finishes, including anodized finishes, polyester powder coating and dual colour options (as specified for Mount Pleasant), with the leading manufacturers bringing the entire process in-house to ensure complete control of the quality of the finished product.

As with any material, quality is of supreme importance – both throughout the manufacturing process and of the finished product. In this regard, systems companies subject their products to a rigorous quality regime, from the raw extrusion right through to the finished profile. It is this focus on every aspect of the product that has led specifiers, contractors and installers to increasingly value the qualities that aluminium systems can bring to new build and refurbishment projects, from elegant aesthetics to improved thermal performance and assured long-life.

Lead – a contemporary building material

Richard Diment, Lead Sheet Association (LSA) executive manager, discusses the relevance of rolled lead sheet in modern construction

Lead is often perceived as a heritage material. That is understandable, considering that it has been used in construction for centuries, and there are examples all around us of lead on historic buildings still performing excellently a hundred or more years after installation, with minimal maintenance in the intervening years.

However, there is an ever increasing realisation that rolled lead sheet is a very suitable choice for use in the most modern of applications. Architects and specifiers are making use of lead's aesthetic qualities, which actually improve with age as it weathers. It is often used in conjunction with other natural materials, such as slates or timber, often to meet requirements of planning regulations insisting that as much natural material as possible is used to blend in with the building's surroundings in countryside settings, or to provide a look of quality and distinction on a modern, inner city building.

Indeed, the malleability and workability of lead enables intricate detailing and high quality specification to be fulfilled. An example of this was a garden house extension in Sussex designed by David Rea Architects. The building made use of rolled lead sheet alongside Siberian larch timber, winning a RIBA award, with the judges particularly impressed with lead fixing points on the facade. In a more urban setting, the refurbishment of Marconi House, site of the first BBC Radio Broadcast on the Strand in central London, made use of rolled lead sheet alongside Hilltop Autumn Green natural self-weathering slates, incorporating 54 lead covered dormer windows, to stand impressively among its salubrious surroundings.

A green and cost effective material

It's not only British Standard lead's aesthetic qualities that make it suitable for modern construction projects. It also measures up well on the most modern of criteria – its green credentials. Now included in the *BRE Green Guide to Specification*, rolled lead sheet has been awarded ratings of A+ or A over a large variety of typically used roofing and cladding applications, demonstrating that lead has a significantly lower carbon footprint than alternative materials. Separate research by Franklin + Andrews also confirmed lead's impressive life cycle costs finding that, over a 40 year period, lead can be up to 50 per cent cheaper than manmade flashing products and over 65 years it is almost 100 per cent cheaper. The research also indicated that, unlike lead, man-made products are susceptible to degradation resulting from UV radiation. This can result in the breaking of internal bonds, causing brittleness and reducing flexibility, thereby impacting on life expectancy and weather tightness.

With lead's resistance to UV degradation, its waterproof qualities and its ability to move in sympathy with buildings, it can be relied upon to give predictable performance for over 50 years. For this reason, manufacturing members of the LSA now offer a 50-year warranty on all rolled lead sheet that they sell, as long as it is fitted correctly, and to the specifications of the LSA's *Rolled Lead Sheet* manual.

Continued overleaf...

'Rolled lead sheet has been awarded ratings of A+ or A over a large variety of typically used roofing and cladding applications'

'Lead gets you out of tricky corners'

Supporting the industry for decades

In the interests of encouraging the highest standards of leadwork possible, the LSA offers a range of technical services to specifiers and installers of rolled lead sheet, including a telephone support service providing guidance on the correct installation of rolled lead sheet as well as site surveys and condition reports. Alongside these services the LSA has recently launched a *Register of Leadworkers*, in response to frequent requests to recommend a qualified leadworker. The register will have a dual benefit: leadworkers will be able to demonstrate the level of skills they have when asked to take on work and when promoting their businesses, and construction employers and the general public will be able to make sure the person they are selecting has the right level of competence for the job.

Decline in metal theft

The LSA sometimes hears from specifiers that a possible deterrent to using lead in construction can be the perceived issue of metal theft. A little publicised fact is that lead forms a very small proportion of overall metal theft, typically less than 10 per cent. Furthermore, there is clear evidence that the perception of metal theft far exceeds reality. A 40 per cent reduction in overall metal theft has been recorded in the last year, building on similar reductions in previous years. The introduction of the Scrap Metal Dealers Act, which requires all scrap metal dealers

to be registered and to record full details of every transaction, is a significant factor behind the sustained reductions in metal theft, with stiff penalties for any dealer found to be breaking the rules.

With British Standard lead's longevity and adaptability to a wide range of applications, it is no surprise that the use of rolled lead sheet is proving as useful and relevant to modern construction today as it did to the Egyptians and Romans all those years ago. As Richard Murphy, a panellist at the recent RIBAJ seminar *Lead – Sustainable, Versatile and Modern* put it: "Lead gets you out of tricky corners".

Galvanizing in the public realm

Modern life can have a habit of being fast, furious and disposable. Long-term thinking is often eschewed for the here and now. We all share a responsibility to balance value for money today with decisions that will remain appropriate for future generations. Material choices, even on the most modest items, can make a tangible difference, as Iqbal Johal from the Galvanizers Association explains

Back to the future – 170 years young

In 1742, a chemist named Melouin presented a paper to the French Royal Academy in which he described how a zinc coating could be obtained on iron by dipping it in molten zinc. Interest in Melouin's discovery spread quickly throughout scientific circles and the first application was to use molten zinc as a cheap protective coating for household utensils.

This period also saw the invention of an engineered material that would help to embed 'galvanizing' into the language of people across the entire globe. In 1829 Henry Palmer of the London Dock Company was granted a patent for "indented or corrugated metallic sheets", his discovery would have a dramatic impact on industrial design and galvanizing.

The London Dock, which had only been built in 1805, was busting with the strain of wine, spices, coffee, cocoa and wool arriving into the world's consumer capital. Henry Palmer was given the job of overseeing the construction of a new dock. To solve the problem of roofing massive new warehouses, he came up with the invention of lightweight corrugated iron sheets. The corrugations made the sheet more rigid so that less framing was required to support it as a roofing material. The first building to use corrugated iron was the Turpentine Shed in 1830. It was praised for its elegance, simplicity and economy.

However, it was soon realised that the iron corroded quickly – a problem to be solved over a period of time by the introduction of hot dip galvanizing the corrugated sheets. Although uncertain, the first use of galvanized corrugated iron is believed to have been for the Navy at Pembroke Docks, Wales in 1844. The use of the material soon spread to the railway industry, being used to span the 212 foot roof of Birmingham's "new Grand Central Railway Station" in 1854.

It was also used for the other landmark station of the time, Paddington, which was designed by Isambard Kingdom Brunel and opened in 1854. Brunel designed a building with 120,000 sq ft (36,650 sq m) of galvanized corrugated iron sheets that enclosed two-thirds of the vaulted roof. The sheets were used in such a way with corrugations at right angles to the roof, so that the whole structure would stiffen. This made the roof a very early example of a stressed skin design. The great advantage of corrugated iron was now coming to the fore, its lightness offered builders the ability to build very large spanned buildings with correspondingly light supporting structures and its use spread across the world.

Galvanizing today

The intervening time has seen iron replaced with steel and galvanizing continues to play an important role away from the limelight given to many other processes.

Today's architects use it because of its unique properties, as detailed by John Parker, ABK Architects: "Galvanizing gives texture to steel, it has a certain materiality and reflects light in a certain way, not found in stainless steel or aluminium."

Others may prefer its longevity and the fact that it provides an alloyed coating.

Perhaps it's the honesty of the coating – the fact that its final aesthetic is based on a mixture of chemistry, steel thickness and design, setting it apart from the over-engineered and inert coatings of more recent times.

A proven, honest and sustainable coating that has not lost its links to the alchemists that created it many hundreds of years ago.

Continued overleaf...

'Galvanizing gives texture to steel, it has a certain materiality and reflects light in a certain way, not found in stainless steel or aluminium'

John Parker, ABK Architects

Worksop Galvanizing – Wedge Group's Nottinghamshire plant galvanized 200 tonnes of steelwork to form the mainframe of the new Subtropical Swimming Paradise at Woburn Forest, on behalf of B & K Structures (above); Scottish Galvanizers – the project saw the organisation's Scottish facility galvanize structural steel on behalf of Russell A. Henry & Son Welding and Fabrication to create unique salt storage barns on behalf of main contractor, Fortnum and Woolley (below)

Rob Mulholland, Skytower, Airdrie, Scotland

Skytower was commissioned by Forestry Commission Scotland for their new woodland park at Rawyards in Airdrie.

The sculpture is made from cut lengths of metal rod which have been shaped to resemble sticks and willow. Each metal rod is welded and interwoven, with over 6,000 welds and 1,400m of steel rod. The sculpture was galvanized in one complete section with a total length of 6m, and stands silhouetted against the skyline overlooking Central Scotland.

It is purposefully geometric with references to standing monolithic stones and historical architectural structures. Skytower captures a moment of flux frozen in time – a sudden gust of wind, an unstoppable force of nature rips through the fragile structure scattering the branches and reshaping the tower.

Proctor and Matthews Architects, Hargood Close, Colchester

Hargood Close is a supported housing scheme in Colchester for vulnerable people in need of emergency temporary accommodation. The development provides a mix of apartments, including studios, one- and two-bedroom dwellings, as well as family houses. The brief called for a mix of dwelling types that would provide more flexible options to help staff respond to the differing living requirements of changing tenants.

All materials for this project have been chosen to reflect the need for attractive surfaces with a domestic feel that at the same time are very durable and robust. To complement the natural warm tones of the brickwork of the main elevations the access walkways feature a galvanized steel structure with perforated and glazed infill panels.

Eco Arc Architects, Lancaster Cohousing Project

Currently the largest certified Passivhaus housing project in the UK, containing 23 three-bedroom family houses, 12 two-bedroom family houses and 6 one-bedroom flats. It has achieved Code for Sustainable Homes Level 6 (carbon neutral). The community owns 2.5 ha of land, including woodland, which it is managing and restoring with native plants.

The design brief provided for a 100 year design life, rather than the 60 years typically used for new housing. For this reason, extensive use of galvanized steel has been made on external finishes and external works such as balconies, porches and staircases.

Skytower by Rob Mulholland (left); Hargood Close by Proctor and Matthews Architects (top right); and Lancaster Cohousing Project by Eco Arc Architects (bottom)

Redefining copper

Sometimes we need to look back to understand the dynamics of developments in architectural materials – particularly metals – and where they might lead in the future. Copper cladding is one example with a growing and diverse presence in contemporary design. Chris Hodson, architect and consultant to international copper specialist Aurubis Architectural, explains

One of our oldest building materials, copper displays unique properties and characteristics. We may still think of it in terms of historic city roofscapes but with the modern movement came a transformation from copper's historic role as a durable roofing material into a flexible architectural skin covering any external surface, including walls. The malleability of copper sheet allows it to be used as a covering for architectural elements of all shapes with minimal constraints. Surfaces can be flat, curved or faceted and used at any inclination or pitch – and in any environment. As a result, architects have focused on copper as a wrapping for building forms with material continuity.

Continuity covering complexity

Built within the Arctic Circle, Jarmund/Vigsnæs' Svalbard Science Centre exemplifies this approach with its 'form follows function' design – informed by wind flow projections – using an external skin of 'mill-finish' copper. Designers continue to exploit this capability today, fired by the complex forms made possible and encouraged by CAD and, now, BIM techniques. But, following on from postmodernism, architects are now keen to explore other possibilities of the material as well.

Copper's continuously changing surface appearance and the natural development of its distinctive patina in the environment still fascinates. Within a few days of exposure to the atmosphere the surface begins to oxidise, changing from the 'bright' mill finish to a chestnut brown, which gradually darkens over several years to anthracite. Continued weathering can then result in the appearance of the distinctive green patina – or blue in coastal locations. This patina film provides impressive protection against corrosion and can repair itself if damaged, defining the exceptional longevity of copper cladding, which can be counted in hundreds of years.

New surfaces

A complex combination of factors determines the nature and speed of patination, taking years or even decades to develop naturally. Not surprisingly, factory applied surface treatments have been popular for some time to provide straightaway the brown oxidisation or blue/green patination that occurs in the environment. Far more choice is available today including different levels of brown pre-oxidisation and various intensities of green

or blue patina. These new opportunities are demonstrated by modern interventions to the Hotel Post at the heart of Gothenburg, Sweden, animated with rich, striated surfaces of copper panels, patinated to varying levels.

In addition, copper alloys have been used throughout history but bronze and brass are growing in popularity for architectural applications today. Most recently, an innovative alloy of copper with aluminium and zinc adds to the palette with a rich golden through-colour that is very stable. The surface retains its golden colour and simply loses some of its sheen as the oxide layer thickens with exposure to the atmosphere to give a protective matt finish. It behaves differently to other copper products over time and does not develop a blue or green patina.

'Copper is being redefined in terms of new surfaces, forms and systems – with a definite sense of freedom – driven by architects'

New forms

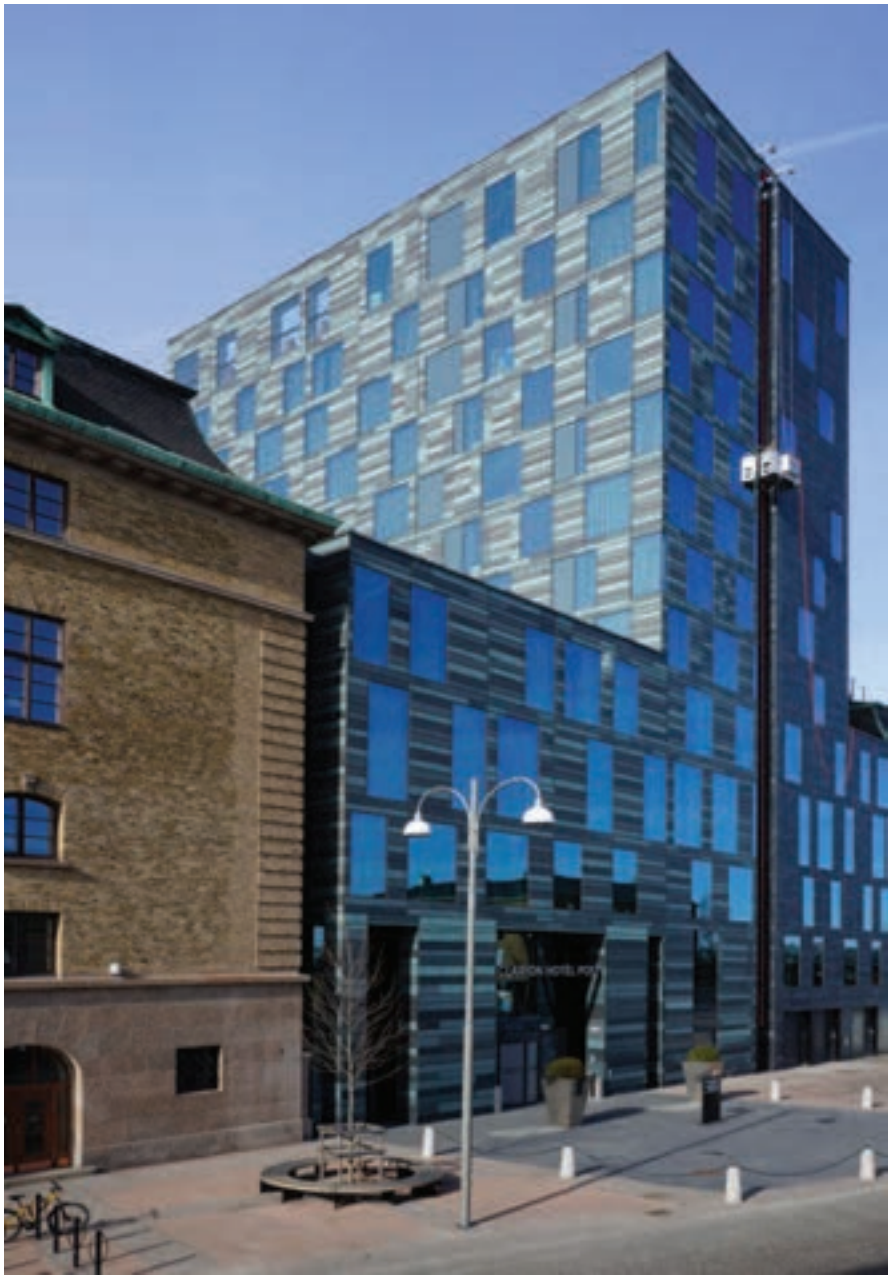
Probably the most exciting developments in metals generally today are with new material forms, creating extra dimensions of modulation, texture and transparency for architectural surfaces – and copper is well suited to this approach. Designers are now working with embossed and pressed shapes, and profiled sheets to add an extra dimension, as well as with perforated or expanded sheets and mesh for transparency and veiled effects. This is illustrated in the Deptford Lounge community building, which includes a rooftop sports pitch, wrapped in horizontal, golden copper alloy panels – some exhibiting varying degrees of transparency.

But designers are also working with new installation techniques for different forms of copper. Traditionally, copper has been used as a lightweight, fully supported covering with joints defining 'bays', determining its structured look. A more modern interpretation is the 'long strip' system where copper trays up to around 10m in length eliminate cross-welts, creating a strong linear appearance.

New systems

More recently, other, generally prefabricated and self-supporting, systems have appeared. For facades, copper panels pre-formed on two sides can be used vertically, horizontally or diagonally. For larger flat areas, cassettes have squarer proportions with folded edges to all four sides, while shingles offer a distinctive 'fish scale' appearance with shapes including squares, diamonds and rhomboids. These installation techniques or systems give 'grain' and structure to the external skin of a building, helping to define its character.

Today, we can see that copper is effectively being redefined in terms of new surfaces, forms and systems and how they can be combined. There is a real impetus for more exploration of the wider design opportunities offered by copper and its alloys for contemporary architecture, with a definite sense of freedom, and this is driven by architects.



Svalbard Science Centre (opposite); Hotel Post (above); and Deptford Lounge community building (left)

Zinc – contemporary designs combine with heritage skills

There can be no doubt that, over the past decade, zinc has captured the imagination of architects for use as a facade, rainscreen cladding and roofing material, as Jonathan Lowy from VMZINC UK explains

'Zinc is considered by many to be the most sustainable of all metals but its success owes as much to the scope it provides for complex detailing'

Pre-weathered colours, which develop the same self-protecting patina as natural zinc, have given confidence that systems retain their appearance while having a long service life and low maintenance requirements. Hundreds of diverse projects have confirmed the metal's suitability for traditional and contemporary designs, both in new build and refurbishment situations. By comparison with other countries, however, the metal's development here might still be described as nascent.

The UK's widespread adoption of zinc has been driven by different factors to countries in which it has been used since the 19th century. Having been at the forefront of sustainable construction, design life value, embodied energy, environmental impact and recyclability have all combined in its favour. Zinc is considered by many to be the most sustainable of all metals but its success owes as much to the scope it provides for complex detailing. This perpetuated the creation of intricate handmade ornamental building features, the skills for which are still alive today. Such specialisation in zinc heritage work continues alongside research and development to produce new systems and colours for contemporary architecture.

The craftsmen who create handmade ornaments do so under the collective name of 'Les Ateliers d'Art Français'. They are, in many cases, descendants of the original French zinc workers and their creations range from bullseye dormers, decorative hopper heads, cupolas and domes to decorative guttering, finials and

Wallace Collection

weather vanes. Such ethereal work provides illustration of zinc's value in conservation and restoration. Recent work to re-roof the Grade II listed Wallace Collection building in Paddington saw handmade bullseye dormers produced to enhance the roof's classical appearance within conservation area guidelines. They are actually used within a batten capped roof to disguise ventilation outlets.

By contrast, standing seam systems predominate in present day building envelope work. There is, however, increasing evidence of the use of interlocking, overlapping, flatlock and composite panels, honeycomb-backed cassettes and shingles. With so many architects regularly specifying zinc, a newly developed engraved finish followed input from over 400 of them. As the first such material to be introduced, its matt surface is unlike any other finish or colour and its delicate surface variation takes advantage of varying light diffraction. A new manufacturing process has enabled acids, water consumption and waste to be reduced and though the material has an uneven surface it does not support accumulation of contaminants or take fingerprints. For those seeking the sustainable benefits of zinc in a very light colour it has filled a long standing gap in the market.

The composite panel, two sheets of zinc 0.5 mm thick heat bonded either side of a mineral-rich polyethylene core, is another less well known development. It provides exceptional fire resistance in a panel which is just 4mm thick and light in weight. Lengths of up to 6,000mm can be installed in colours which now include subtle shades of green, red and blue.

Colour variation is a further facet of zinc development which is relatively little known. The soft tones are unlike those available in other metals and enable them to be used in combination to striking effect. The naturally grained texture of pre-weathered zinc remains visible as BDP's design of the £80 million University of York campus expansion illustrates.

Project architect Andrew Lees said of factors which inspired the cladding design: "Our vision was prompted by the rural surroundings and specifically by the lakeside location. We felt that the elevations should reflect colours which stemmed from flora such as bulrushes. We realised that the combination of subtle shades of grey, green and red would enable us to create a colour palette which was visually analogous to the rhythm of multi-stemmed plants. A particularly satisfying feature of the zinc is the crisp shadow gap that is achieved between adjacent panels. This gives the skin of the building a textured sophistication and the ability to form a continuous wrap around both the straight and curved sections of the facade."

When considering the efficacy of zinc, what stands out is the diversity of projects in which it is being used. Schools, hospitals, apartment blocks and hotels may not resonate as commercial projects of note but all have individual aspects of design which set them apart. Others such as railway and bus stations, sports venues, retail outlets and visitor centres (such as that at Stonehenge) undoubtedly draw greater attention. Heritage projects provide a showcase for the best in handmade zinc but commercial projects are now showing just how aesthetics can combine with high performance in the modern building envelope.

'We realised that the combination of subtle shades of grey, green and red would enable us to create a colour palette which was visually analogous to the rhythm of multi-stemmed plants'

Andrew Lees, York University project architect, BDP

York University

Dipping has the edge over blasting

If a priceless piece of architecture has not been renovated for over 100 years, how can you clean it thoroughly without losing any of its decorative features? Forget shot blasting and dip it in a tank, says Adrian McMurray, MD of chemical cleaning company Surface Processing Limited

'Fine detailing painted over multiple times and not seen for years can often be uncovered'

'God is in the details' believed Ludwig Mies van der Rohe, one of the great figures of 20th century architecture. His words were directed at contemporary designers but his dictum is equally resonant for restorers and conservators. Their goal is to preserve detail, if not rediscover it, during the conservation of a building.

The magnificent south entrance gates of the Piece Hall – Halifax's Georgian masterpiece and one of only two fully intact cloth halls in Europe – were made in 1871 but today look pristine following an extensive repair and renovation programme. The first task of the conservation team, charged with restoring them to their original condition and decorative scheme, was to remove the layers of old paint, grime and rust that had accumulated over decades.

The worst thing they could have done was to use the traditional method of shot blasting. This tends to round off sharp edges on wrought iron objects and structures, meaning intricate detailing and design elements can be lost for good. Moreover, it's difficult to remove paint from inside box sections and voids, awkward corners, and all the nooks and crannies.

An attrition method like this will also attack the substrate, so not only do you lose definition but the metal surface starts to deteriorate as well. There is another drawback: cast iron, of which the Piece Hall's beautiful gate panels depicting John the Baptist are made, can crack if blasted. And while the process itself is cheap, it can be very messy – you need to factor in the on-site clean-up costs.

The conservators opted for a better way – fully immersive chemical cleaning. This process is made up of several washing and rinsing stages as the item is dipped in a range of different cleaning fluids. It is far gentler and more effective than high-pressure cleaning at removing paint, varnishes, rust, grease, sealants, adhesives, scale, oils, acids, and other organic and inorganic matter. The stripped metal will look bright and shiny.

All this can be accomplished without losing any decoration or ornate features – fine detailing painted over multiple times and not seen for years can often be uncovered too – or compromising the integrity of the substrate. The chemicals used are safe to use on a variety of ferrous and non-ferrous metals including brass, copper, steel, aluminium and iron. The temperatures involved at any stage are relatively low – no more than 80°C – so you don't have to worry either about distortion or softening of the metal, which might occur with high-temperature treatments. Objects several metres in length and weighing several tonnes can be treated.

A further advantage is that you are now working with bare

and stabilised metal surfaces. Wear and tear, corrosion damage or earlier repairs are clearly identifiable. If new repairs are needed, you can achieve a much better quality of welding and weld integrity because there are none of the complications encountered with paint, sealants and other materials. As a result, structural rigidity can be improved markedly.

Of course, decontamination, rust removal and cleaning are just the first steps of the restoration process. The next stage, priming, is particularly important and here another modern technique is being increasingly relied upon for restoration projects.

Called electrophoretic coating or simply 'e-coating', this again involves fully immersing the item, ensuring you get equal coverage of the primer, even in those hard-to-reach places. Then 400 volts is passed through the tank, which fully bonds a uniform, durable coating of 28 microns to the metal. This compares to a thickness of 60 to 70 microns you would normally get from a galvanized finish. The thinner e-coating follows contours, shapes and edges more faithfully, giving better protection and a longer-lasting paint finish. It also means you don't lose detail after painting; even threaded items will still work after they are painted.

E-coating is widely regarded to be the best anti-corrosion primer. That's why 97 per cent of the world's car manufacturers apply it to their vehicles to provide long-term protection against rust. For complex metal objects and structures, there is nothing better.

Chemical immersion followed by e-coating is proving a popular combination for renovation projects on modern buildings where shot blasting and conventional coating have failed to remove rust and then prevent it reforming on, for example, balcony panels made from perforated stainless steel.

However a coating or primer is applied, cleaning by chemical immersion is still more practical and more cost-effective in the long term. It provides the perfect foundation for any rebuild or restoration project where a key priority is the preservation of an object's historic character.

'E-coating is widely regarded to be the best anti-corrosion primer. That's why 97 per cent of the world's car manufacturers apply it to their vehicles'

Levolux creates curves in Crawley

Land Securities' new £39 million mixed use development on the former Sussex House site is taking shape, showcasing a curvaceous solar shading and screening solution by **Levolux**. The solution comprises extruded aluminium rectangular-shaped fins, each measuring 175mm deep by 50mm thick. The fins are arranged vertically, secured between custom extruded aluminium 'C' section channels, each measuring 175mm high by 80mm deep. All fins are fixed at a pitch of 400mm, following the horizontal channels, which continue along straight and curved elevations. The combined screen extends an impressive 390m in length, with a maximum height of 12m. Most fins are fixed at 90 degrees from the facade (fully open), creating a uniform external aesthetic.

Metal Technology used in Portsmouth project

Metal Technology environmentally-friendly curtain walling, window and door systems have been installed on the recently opened Community Hub in Somerstown, Portsmouth. A key part of the regeneration of the Somerstown area, the BAM designed and built Hub is set to become an architectural landmark in the city. Consistent with the curtain walling systems, Metal Technology System 5-20 Hi+ thermally enhanced tilt and turn windows, rooflights and 5-20D door system were installed, which – with the System 10 Commercial Door – combined to contribute to the building's BREEAM Excellent rating.

028 9448 7777 www.metaltechnology.com

Revolutionised steelwork fire protection

As one of the most respected names in the field of intumescent coating technology, Nullifire – a **Tremco Illbruck** brand – has in the past asserted that its water-based systems were capable of moving this essential work off the critical path for many projects – but now the manufacturer has made a game-changing advancement which radically reduces the time taken. Rather than being classed as either a traditional solvent based system, or a more modern water based alternative, Nullifire's SC901 and SC902 are two-pack high solids treatments which can be applied as a single coat. Where another intumescent protection system would previously have been built up over four or five visits, SC901/902 can be sprayed as a single coat.

Architectural systems by DML Group

Architectural systems expert DML Group specialises in external aluminium facades, cladding, windows, unitised and curtain walling. The company works with architects and specifiers across a diverse range of schemes and is a preferred supplier for several of the UK's largest main contractors.

Among DML's major schemes are a facade for the Oxford Street entrance of Tottenham Court Road station along with glazing and stainless steel cladding, part of TfL's £0.5 billion station redevelopment; and bronze shopfronts, glazed roof lights and cladding for the St James' Gateway mixed-use commercial, retail and residential development in London's West End.

The company has also completed a unique artwork project at An t-Eilean (The Island), which involved bronze cladding, doors and balustrades for a walled pavilion garden in the centre of Inverness Campus, a multi-stakeholder, 215-acre business, research and education facility developed by Highlands and Islands Enterprise; and the West Narthex project at Ripon Cathedral, which involved the installation of new glass porches at the west front of the cathedral, which was built over 1,300 years ago.

DML's most recent retail schemes include several new branches of a major bank; two of the country's leading shopping destinations – Trinity Leeds and London Designer Outlet; and a number of bronze and aluminium facades for the stores of some of the world's leading brands.

DML Group offers a total capability solution from design and build to the manufacture of bespoke shop fronts and curtain walling systems, and a full turn-key provision. The company has extensive involvement in the retail, education, residential and public sectors and works both nationally and internationally.

Contact DML Group on ***0113 256 5661*** *or visit* ***www.dmlgroup.co.uk***

Walthamstow blues

A 13-storey hotel next to Walthamstow Central Station, London, has been clad with Nordic Blue Living copper from **Aurubis Architectural** alongside black brickwork. Located on a prominent town centre site, the 107-bedroom hotel forms a key part of a mixed-use scheme that will also provide new homes, retail space and a landscaped public realm. The £20 million scheme has been developed by Solum Regeneration, a partnership between Network Rail and Kier Property, and will help revitalise this area of the town centre, creating a new urban gateway. Designed by Rolfe-Judd Architects, the hotel tower is conceived as a series of vertical articulated masses, differentiated by facades clad either in black brick or Nordic Blue Living 1 copper. Nordic Blue is a factory-applied patina developed with properties and colours based on the same brochantite mineralogy found in natural patinas all over the world. In marine climates, the natural copper patina contains some copper chloride giving it more of a blue colour and this is emulated with Nordic Blue using 100 per cent brochantite. The material is easily bent and formed, and there are no limitations on the length of pre-patinated copper sheet or strip. This enabled the vertical long-strip cladding, as used at Walthamstow broken up by horizontal bands at floor levels.

01875 812 144 www.aurubis.com

Comar 6EFT curtain walling

Due to demand from its architectural and fabricator clients, **Comar Architectural Aluminium Systems** is pleased to launch additional new mullions and transoms for its innovative Comar 6EFT curtain wall system, with the highest Ix and Iy values available on the market today. As Comar 6EFT has developed to be the specifier preferred system in the UK, demands for larger transom spans in excess of 3,000mm and unsupported multi-storey mullions are a possibility. Where there are different glazed areas in the same envelope Comar has also extruded high span mullions and transoms in the most popular box sizes, which mean that the same box size can be used throughout the project to ensure that all fixing and plaster lines throughout the facade are continuous. To provide a flexible approach to aluminium facade engineering Comar's 6EFT curtain wall system utilises European wide design and extrusion expertise with Comar's market leading supply, support and delivery. With its exceptional design flexibility, Comar 6EFT provides high performance solutions for new build and refurbishment facades. It is a flexible standardised system that provides bespoke solutions. Comar 6EFT has undergone rigorous tests for the latest BS and EN standards at Taywood Engineering Ltd., with exceptional results: Air Permeability – Class AE 750, Water Tightness – Class RE 750 and Wind Resistance – 2400 Pa, Safety 3600 pa.

Accessories critical to metal roofing

Accessories used with metal roofing can have a dramatic impact on thermal performance, design life and aesthetics. ALM's unique position as a supplier of metals from all of the leading manufacturers has led them to assess fixings and insulation materials in considerable depth. It supplies Warmfast fixings as their effectiveness in avoiding thermal bridging is acknowledged throughout the industry. From a practical perspective, however, it also enables a compact roof build-up to be used, saving a 40-50mm air gap and an 18-20mm thickness of plywood.

Andy Denham of ALM HM commented: "Warmfast fixings remove the vented void so the Warmfast vapour barrier must also be used. It self-seals around fixed points ensuring vapour drive is adequately controlled and kept on the warm side of the insulation. The vapour barrier is also reinforced preventing potential tearing resulting from foot traffic on trapezoidal decks".

Warmfast sizes can accommodate insulation thicknesses of up to 970mm and has a 'telescopic' function which adjusts to accommodate compression. The fixing itself has three elements: a high grade stainless steel plate, a synthetic peg and a galvanised screw. The plate has a similar fixing centre to a conventional cleat but with a significantly better pull-out value of 1kN using one screw fixing rather than two or three ARS nails.

Warmfast fixings and vapour barrier are also used with insulation materials that ALM supplies, such as Linitherm PGV Flex. This is a flexible but highly resilient insulation board used for curved roofs such as barrel vault and eyebrow dormer designs. It is strong enough to walk and kneel on and, being laid to curve, needs no cutting. Available in 60mm and 80mm thicknesses, a minimum of two layers are used, staggered to reduce any possibility of faceting in the curve. This answers a common problem with curved metal roofs as cutting rigid boards to curves invariably leads to clearly visible faceting through the metal.

The roof of the Artists' Studio in Bristol, installed by Boss Metals, has fairly tight 4m to 6m radii that vary from one end to the other. Despite this, the Linitherm PGV Lex insulation was formed to the curves without difficulty. The build-up was a plywood deck, foil-faced vapour barrier, two layers of Linitherm boards laid staggered, structured underlay and a Rheinzink covering in blue/grey installed using Warmfast fixings.

Haslemere, a self-build by the owners of Dove Construction and installed by GSL Ltd, also has a curved zinc roof. The value of such a design for any self-builder is originality of appearance and the fact that the roof becomes a feature in its own right. The ultimate aesthetic, however, depends heavily on surface uniformity and Linitherm PGV Flex fulfils this demanding requirement while also providing a low U-value. Panels can be sawn, cut, drilled, nailed or glued and have high compressive strength, dimensional stability and low weight. They will not degrade over time and are fully recyclable.

Another Linitherm product supplied by ALM HM is PAL OSB, a highly engineered, rigid board bonded to exterior grade OSB. Edges and the insulation are channelled to prevent the uncontrolled vapour drive that occurs with butt-jointed boards. Other high specification insulation systems include those manufactured from recycled glass by Foamglas. It is totally impervious and fire-resistant and not only fully recyclable but, load bearing. It provides a total vapour barrier and is therefore the recommended means of insulation for metal roofs over swimming pools and other building types where vapour drives are extreme.

With the diversity of metal colours, textures and finishes continuing to increase in addition to the resurgence in lead for heritage projects, specialist distributor support has never been more important. As one of the UK's largest lead, hard metals and ancillaries supplier ALM is uniquely placed to provide such support for projects of all size.

Contact ALM today on ***01992 444100*** *or visit* ***www.almhm.co.uk***

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Affordable aesthetics and high performance

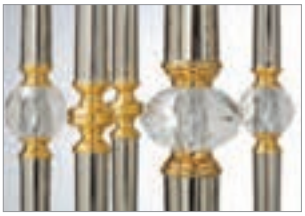
UGINOX terne-coated stainless steels from **Aperam** are invariably lower in cost per square metre than copper or zinc; their inherent strength enabling them to be used at gauges as thin as 0.4mm.

Overall weight savings can therefore be as much as 35 per cent. UGINOX Patina also takes on the natural patina of aged lead sheet, prompting English Heritage to endorse it as an alternative to lead. All require minimal cleaning and maintenance and offer complete resistance to underside corrosion.

Perforated image panels

E E Ingleton has completed two prestigious projects in London using its new PicPerf© image perforation system. Using the new software, panels were manufactured for Cadisch MDA installed on the Kingston Riverside development, and for Dane Architectural Systems for the new 'Project Lions' facades on Debenhams flagship Oxford Street store. Ingletons also manufactured the 187,000 perforated tiles that make up the kinetic facade around the store. The Kingston Riverside panels were based on a scenic photograph and a classic motion study by the Victorian photographer Eadweard Mybridge. The Project Lions perforated panels and embossed soffit panels were based on a classic French Lace pattern.

Balustrades from Kensington



If your special project wants to have that perfect finish then one of **Kensington Balustrade Systems'** Chrome Nickel or Swarovski crystal balusters will allow you stand out from the crowd. Kensington only supply the highest quality balustrade components. Kensington also stock a full range of aluminum channels for glass and stainless steel balustrading, if required these can be powder coated any colour to match surrounding floors. Kensington's solid brass profile handrails as always will add a certain elegance to quality projects.

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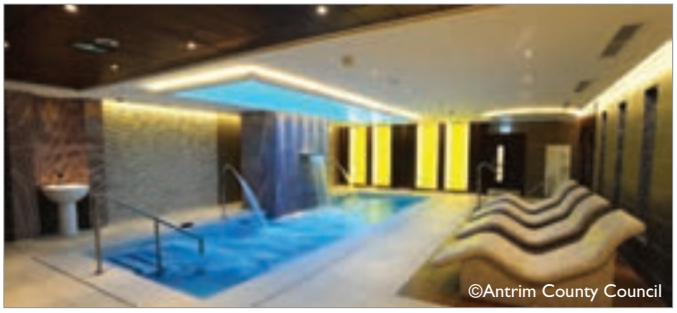
ALM rolled lead focal point for school roof

The Harrow School conservation area contains buildings which are some of the best known in and emblematic of Harrow. One of the most eye-catching is the semi-circular rotunda roof of the Grade II-listed Old Speech Room built in 1819-21. Richardson Roofing used **Associated Lead Mills (ALM)** code 5, 6 and 8 lead for the complex refurbishment for which ALM also supplied the wood roll substrate. The roof required modification as the rotunda original wood roll layering was in a pattern which used the girth rather than the taper of the lead. With the splash lap facing into the fall of the roof, patterns crossed the fall line 'worming' and causing leaks. The solution was to radiate rolls to natural falls from a raised tier at the pinnacle of the roof using it as a hub to hide roll ends. Segments of king roll and wood rolls had to be lost and in order to offset the problem whereby laps appeared too large, the base of wood rolls was rebated and covered in lead.

01992 444100 www.almhm.co.uk



Armstrong effects on metal

A snapshot guide to the effects that can be achieved on its metal ceiling tiles and planks for prestigious high-end projects has been launched by **Armstrong**. A four-page A4 brochure shows the standard 'effects on metal' range of bronze and chrome as well as five woods (Ash, Oak, Red Oak, US Cherry and US Walnut), but also refers specifiers to the manufacturer for any other effects or configurable solutions they want to achieve. The range is available in 300mm x 1,200mm planks as well as the standard 600mm x 600mm tiles and in extra-microperforated as well as unperforated options. It uses three suspension systems – Armstrong's concealed Q-Clip F and S Clip F for the tiles and planks and semi-concealed Axal Vector with a discreet 6mm reveal for the tiles. Manufactured from up to 30 per cent recycled content, acoustically the range performs up to 0.55(L) αw (alpha w) using a black acoustic fleece on the rear of the extra-microperforated tiles. It is also resistant to fire (A2-s1, d0) and humidity (95 per cent). The 'effects on metal' range is also cleanable and available in an anti-bacterial Bioguard finish to meet the additional cleanliness requirements of healthcare premises.

07000 256467 www.armstrong.co.uk

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