Metal in architecture

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September 2015

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The sustainability and design life of zinc, copper and stainless steel facade and roofing systems have been major drivers affecting their growth. Improved cost effectiveness has also encouraged greater awareness of their technical performance and the scope they provide to create buildings of lasting visual impact. By Andy Denham, business development manager, ALM HM

Photograph © RMIG
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Printed in England

Editor's letter

I am delighted to bring you the 2015 edition of ADF's Metal in Architecture. Metals have long been known for their durability, longevity, low maintenance and sustainability, however new technology, methods of manufacture and skills, are making many metals a more cost-effective choice, whilst driving improvements in energy-efficiency, performance and aesthetics.

In this supplement we therefore look at some of the latest developments in the industry and explore how metals are combining both the essential structural and aesthetical qualities that allow architects to create buildings and structures that will stand the test of time and inspire future generations.

Excellent examples of this can be seen in our report by Chris Hodson on the European Copper in Architecture Awards. The ten shortlisted projects are exemplars of the high standards in contemporary architecture and illustrate the versatility of copper and its alloys.

As there has been interest recently in the use of metals for 3D printing to create major structural components and large scale structures, Stephen Cousins reports on this revolutionary technology, its possibilities for architecture and the big impact it could have on the world of construction. He speaks to some of those involved with the research and pioneering plans that are underway.

We are very grateful to our contributors who provide information and guidance on many topics related to metals. For example, we learn more about the Aluminium Stewardship Initiative (ASI) from technical director of the Council for Aluminium in Building (CAB), Dr Justin Furness. The Metal Cladding and Roofing Manufacturers Association (MCRMA) outlines why metal systems are a sustainable, energy-efficient choice and the Metal Gutter Manufacturers Association (MGMA) discusses the benefits of metal gutter systems. We also hear from Richard Diment, chief executive of the Lead Sheet Association about how lead is meeting the demands of both new and old building projects.

In addition we showcase examples of innovative uses of metal in construction, whilst experts in their field provide information on the new developments in metal and its processes.

Sarah Johnson

Britcon in steel job for King's Cross gym

Britcon Engineering Services (BES) has completed a major contract to install supporting steelwork for the refurbishment of the listed 19th Century 'Germany Gymnasium' in King's Cross.

Originally designed by Edward Gruning, the Grade II listed building was first built in 1865 for the German Gymnastics Society.

While retaining the original facade, the internal space has been totally reconfigured over three new levels and BES has designed and installed a bespoke structural frame to support this.

Nick Evans Director at Britcon Engineering Services, said: "This structure was designed as a series of moment frames with depth restrictions and the completed frame had to fit around the original cast iron and timber structure inside the listed building. The Clerestory roof was particularly difficult to erect as it was positioned in the existing high level vault area with new MacAlloy ties running across the span of the building. This lead to some challenging site work using bespoke lifting equipment and spider cranes operating in a very tight environment."

This is the second project carried out on the site by BES for main contractor Bam. It installed structural steelwork for building E2 which was completed in 2014.


Steel and Glass features for Omsk © Malishev Engineers


Melbourne School of Design © John Wardle Architects


September 11 Memorial Pavilion © Jeff Goldberg

AWARDS SHORTLIST

The Structural Awards 2015 Shortlist: The amazing world of engineering

The shortlist for The Structural Awards 2015 has been released by The Institution of Structural Engineers, celebrating the extraordinary achievements of structural engineers around the world.

Structures from 13 nations are recognised, including the tallest observation wheel in the world, a bridge modelled on a Japanese hand fan, a memorial to victims of the September 11 terrorist attacks, and an 'amphibious' house. The winners will be announced at The Structural Awards ceremony in London on Friday 13 November 2015.

Martin Powell, Chief Executive of The Institution of Structural Engineers, said: "This year's shortlist illustrates the extraordinary scope and beauty of great structural engineering, and the amazing range of abilities engineers have: designing everything from practical, affordable housing for developing nations and spectacular showpiece structures to vital infrastructure solutions and projects to mitigate the effects of climate change.

"This Structural Awards shortlist really recognises the outstanding professionalism and creativity of structural engineers and the profound effect they have in helping to shape our world."

To view the complete shortlist plus further information on The Structural Awards, visit www.architectsdatafile.co.uk and enter reference number 43118.

COMPETITION

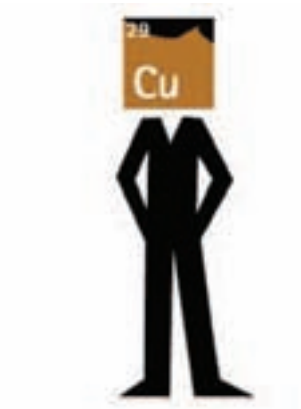
Copper Education Competition prizes awarded

12 students from across the UK have been awarded prizes in this year's Copper Education Competition, with a further three awarded Highly Commended.

UK students aged 11–16 were asked to design an educational poster, which would appeal to their peers, explaining particular applications of copper and the properties that make it essential to modern living.

Within the two age groups (Key Stage 3, 11–14 and Key Stage 4, 14–16) a winner and a runner-up were selected from each of the three categories. Students were expected to address the questions, although innovative explorations of each subject were also welcomed.

Copper and its alloys have been a material of choice for architects and



designers for centuries. In the Buildings and Design category, students were asked to explore the reasons for this, and the properties that make copper such a versatile and attractive material.

Copper has played a key role in the development of electrical applications and is used everywhere from smart phones to space exploration. In the Electronics and Communication category, students were asked to explain the properties that see copper so widely-used in these fields.

We need copper in our diets to stay healthy, and its inherent germ-killing ability makes it the ultimate hygienic material. In the Health and Medicine category, students were asked why it is essential to our health and how can it contribute to safer hospitals.

With prize letters and cheques issued to schools, for the winning science departments and students, preparations are now under way for the launch of the 2016 competition later this year.

BOOK

Dr Arthur Lyons' Materials for Architects and Builders

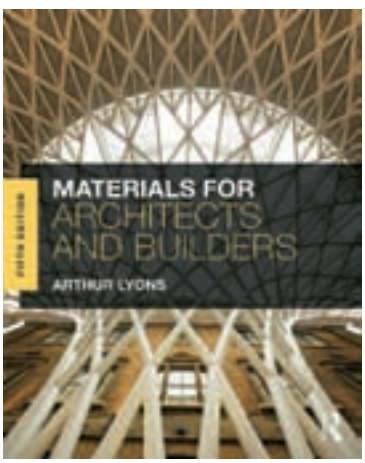
The fifth edition of Materials for Architects and Builders by Dr Arthur Lyons, former Head of Quality, principal lecturer and teacher fellow in the Leicester School of Architecture at De Montfort University, Leicester, has been fully updated to the current Building Regulations and is extensively referenced to BRE journals, trade association publications and the relevant British and European Standards.

The useful guide for specifiers, describes the broad range of materials used within the construction industry and covers essential details of their manufacture, key physical properties, specification and uses and contains a detailed section on metals.

New and developing materials are included where they will impinge on future building construction, and traditional materials with resurgent interest due to their ecological credentials are also described. Colour images illustrate many materials and their use in buildings of national and international interest. Materials are described under traditional chapter headings for accessibility.

A wide range of energy saving components, including photovoltaics and sun pipes, are also described, and a further chapter is devoted to recycled materials. The ecological effects of building construction are considered for all the main materials and the final chapter focuses on sustainability within housing.

The paperback edition is available from the publishers – Routledge, national bookshops, many university bookshops and through Amazon. An electronic version is available from Routledge and Amazon.



Arthur Lyons MA, MSc, PhD, Dip Arch Cons, Hon LRSA, FHEA was a lecturer in building materials for thirty-five years and is now an established writer on construction materials.

Operational energy efficiency

Dr Justin Furness, CAB technical director, discusses why aluminium is an energy-efficient option and outlines the role of the Aluminium Stewardship Initiative (ASI) in responsible sourcing

'Whichever direction the regulations take, aluminium remains a smart choice for the framing material'

The need for investment in energy efficient buildings has featured in several of the political manifestos during the recent general election campaign and also in a number of recent reports and initiatives that have highlighted the potential benefits of installing energy efficient glazing, as well as the complex nature of the issue. The building sector in Europe is responsible for more than one third of the energy consumption and a similar share of the CO2 emissions associated with human activities. Meanwhile Britain has some of the oldest housing stock in the world; it is thought that more than 8.5 million British properties are over 60 years old. There is no question that something needs to be done.

The National Energy Foundation (NEF), with the support of the glazing supply chain (comprising: Glass and Glazing Federation (GGF), British Glass (BG), Flat Glass Manufacturers Association (FGMA), Steel Window Association (SWA), Council for Aluminium in Building (CAB) and European Window Film Association (EWFA)), has recently reported on the operational energy reduction potential in the existing building stock, driven by accelerated uptake of energy efficient glazing (see www.glazingsupplychaingroup.co.uk). The study looked at several scenarios and even assuming a relatively modest increase in the uptake of enhanced glazing products, by 2050 energy consumption during the heating season could be some 15,000 GWh lower compared with maintaining the current rates of renewal. To put this in context, it is roughly equivalent to the energy generated by two Sizewell B nuclear power stations. It was also estimated that another Sizewell B nuclear power station could be saved if energy leakage around windows could be reduced through improved installation practices. It is therefore crucial that we adopt a more holistic approach to buildings, considering the interaction between the components, the building, the occupants and the climate, and how they are all put together.

While efforts to stimulate the retrofitting of energy efficient glazing in existing buildings continue, the government has recently announced that it is dropping the zero carbon targets for new buildings, along with the Allowable Solutions carbon offsetting scheme. This should help drive up the number of houses built and improve the UK's productivity, arguably two critical metrics for a developed economy, as well as allow more time to evaluate the impact of current regulations. We therefore take this opportunity to spread the message that energy efficiency is not restricted to consideration of the heating season only (in the UK) and that it cannot be regulated in isolation from other parameters that directly affect energy usage and occupant comfort. The industry, including architects, product manufacturers, fabricators and installers, has a difficult balancing act to strike when it comes to glazing in particular, and we must work together more to address this. For example, it is common sense that the size and orientation of glazing are important factors when it comes to making this balance.

Building Performance Institute Europe (BPIE) has recently carried out a review of residential building regulations in eight EU Member States (http://bpie.eu/indoor.html). This report stresses the importance of having appropriate requirements for thermal comfort, ventilation and daylight conditions. All told, we spend some 60-90 per cent of our time indoors, so indoor air quality plays a vital role in our health and wellbeing. Improving the air tightness of buildings is again identified as an important factor, as well as the need for ventilation control and air exchange. Our target in this regard as an industry is now set out in the EU's Energy Performance of Buildings Directive, under which the UK has to deliver nearly zero energy buildings from 2021 (and from 2019 in the public sector). Will it be possible for building regulations to evolve from requirements for energy performance to requirements that also ensure a holistic approach to thermal comfort, indoor air quality and daylighting?

Whichever direction the regulations take, aluminium remains a smart choice for the framing material, offering, for example: narrow sight-lines thereby maximising daylight and access to surrounding views, thermally broken profiles thereby reducing heat loss, sections with exceptional strength to weight ratios thereby allowing large glazing areas, and a wide range of configurations, from the bi-fold to the tilt and turn. It is also the responsible choice, with exceptional durability characteristics and recycling rates of over 90 per cent.

Cradle to cradle efficiency

Responsible sourcing is becoming increasingly important in the construction sector and rightly so. No manufacturer that values its reputation would want to be associated with corruption or with needlessly wasting precious resources, for example. This is, however, another area where one size does not fit all and several sourcing issues are harder to measure in some sectors than others and are not readily comparable. The value chain for

'Responsible sourcing is becoming increasingly important in the construction sector and rightly so'

a material that can be mined, manufactured and installed locally, for example, will be very different compared with that for a globally traded commodity, such as aluminium.

To address this, several organisations involved in the aluminium value chain have been part of the Aluminium Stewardship Initiative (ASI), which was launched at the end of 2012 (http://aluminium-stewardship.org). Part 1 of the ASI Performance Standard was published in December 2014 and it sets out the environmental, social and governance principles and criteria applicable to the aluminium value chain. Relevant measures for each criterion and the means of verification are in development.

One of the most important principles that the standard sets out is that of materials stewardship, highlighting the need to evaluate life cycle impacts and to promote resource efficiency and the collection and recycling of aluminium. To complement this, ASI has also drafted a Chain of Custody Standard which sets out that, at each stage in the aluminium value chain, materials from ASI-compliant sources are properly managed and only mixed under controlled procedures with materials from sources that meet ASI minimum requirements, and not mixed at all with materials that fall short of the ASI minimum requirements, with these latter materials eliminated from the supply chain.

We will be working with our members over the coming months to evaluate how we could implement the ASI Performance and Chain of Custody Standards in our part of the aluminium value chain, as well as how it matches up against the requirements of BS 8902 (Responsible sourcing sector certification schemes for construction products) and BREEAM in particular.

Aluminium Extrusion Scrap
Image courtesy of International Aluminium Institute

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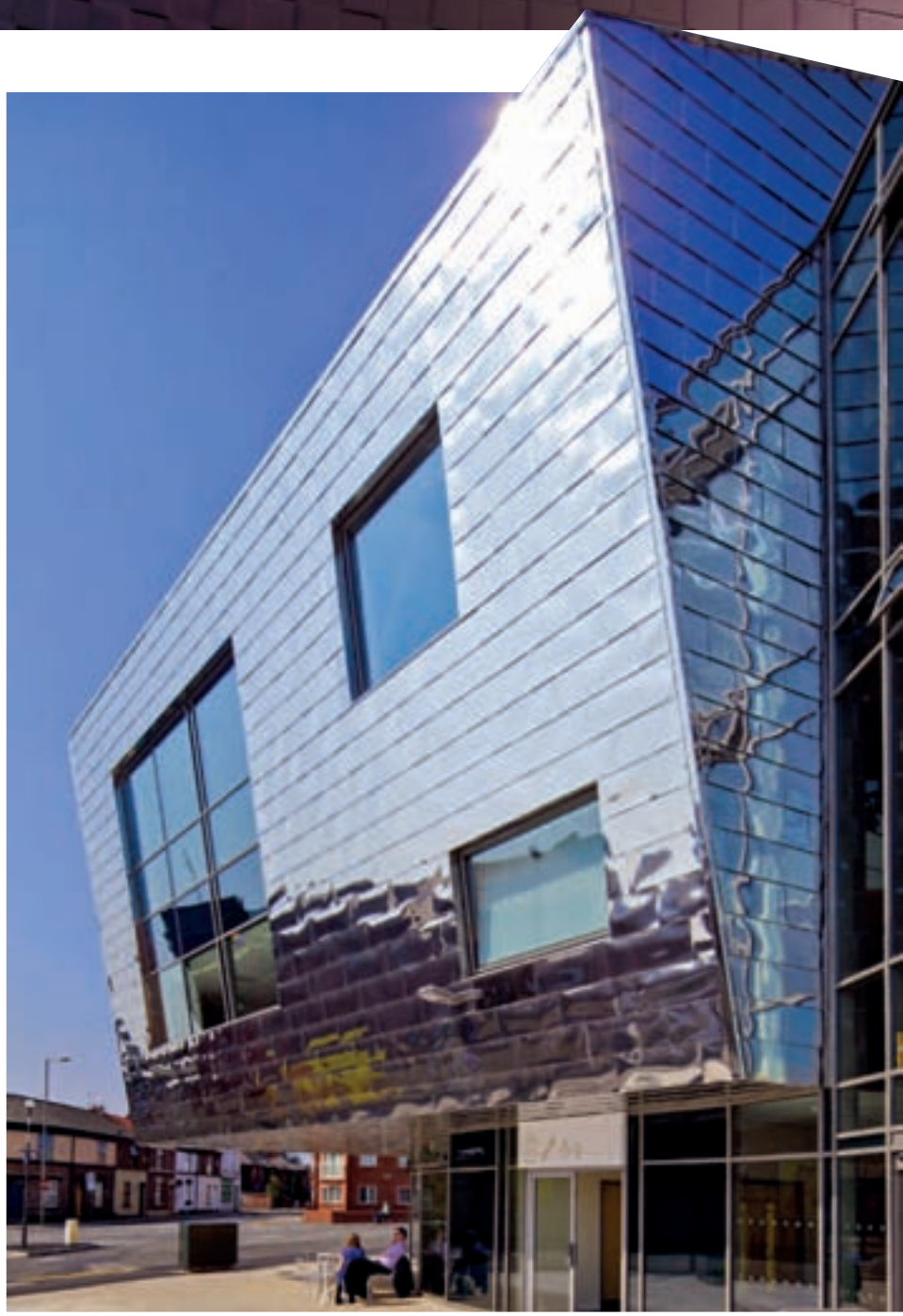

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Metal offers a sustainable future

The Metal Cladding and Roofing Manufacturers Association (MCRMA) explains how metal building envelope systems contribute significantly to the sustainable design concept, thanks to its high recycled content, recyclability and energy efficiency

Energy Technologies Building (ETB) at Nottingham University's Innovation Park
Image courtesy of Ash & Lacy Building Systems Limited.

The Government has announced the end of the UK's zero carbon buildings policy and that it does not intend to proceed with the zero carbon Allowable Solutions carbon offsetting scheme. This means that the 2016 zero carbon homes target is being dropped, as is the 2019 target for non-domestic zero carbon buildings. It also means that there will be no further changes to Part L in any form before 2016.

However, the UK will still be required to deliver nearly zero carbon buildings from 2021 (and 2019 in the public sector) and to meet the nearly zero carbon target, non-domestic buildings will need to be designed and built to be as sustainable as possible and to contribute as little as possible to carbon emissions.

For many years specifiers have chosen metal over other materials for its energy efficiency, low maintenance and durability. However, metal has other attributes, namely its striking beauty, clean appearance and versatility; metal cladding systems offer a choice of steel or aluminium substrate, which can be linked with a range of colours, shapes, panel sizes, finishes, profiles and vertical and horizontal applications. These attributes have established metal as the material of choice for both new and refurbishment construction.

Steel and aluminium offer a better life cycle return on investment than other materials. Today's metal construction products are protected by highly durable paints and coatings that now ensure a service life in excess of 40 years.

Metal construction is efficient and competitive; buildings can be rapidly constructed using metal-based primary and secondary components that are efficiently manufactured off-site and therefore are dimensionally accurate and of known quality.

In order to create truly sustainable buildings, it is critical that project teams take a holistic approach. The building envelope should be considered in a much broader context such as sourcing of materials, durability and longevity of building envelope systems, integration of renewable energy technologies and end of life options. Specifying products that have been certified to an internationally recognised framework, such as BES 6001, will help the design team to validate the 'green' credentials that companies claim. Adopting this approach will lead to a well-integrated, high performance design - bringing potential cost savings and added efficiencies that are far greater than they would be if building elements were considered individually.

Both steel and aluminium can be reused or recycled repeatedly without losing their qualities as building materials. The recovery infrastructure for metal recycling is highly developed and highly efficient, and has been in place for decades. Current recovery rates from demolition sites in the UK are 99 per cent for structural steelwork and 94 per cent for all metal construction products – figures that far exceed those for any other construction material.

Continued overleaf...

'Both steel and aluminium can be reused or recycled repeatedly without losing their qualities as building materials'

SolarWall® transpired solar collector system was used at Jaguar/Land Rover, Leamington Spa. Image courtesy of CA Building Products Limited

When metal is specified for a building, it is unlikely to become waste. Steel and aluminium always have a value and are only ever sent to landfill as a last resort. Waste generation is one of the least sustainable aspects of construction; choosing a metal-framed and clad building incorporating highly efficient insulation is the simplest and most effective way to reduce waste. Even during manufacture and fabrication, any swarf or offcuts are recovered and recycled back through the primary production process.

Changes to Building Regulations will result in more renewables being installed on both new and refurbishment projects. MCRMA members are at the forefront of developing innovative metal roofing solutions such as photovoltaics (PVs) and transpired solar collectors (TSCs) which will contribute to achieving the nearly zero carbon target. Examples include the integration of solar PV systems with existing and new roof assemblies, enabling buildings to generate their own electricity; and the development of perforated TSCs to deliver naturally warmed fresh air into the building. MCRMA members have developed functional coated steel products based on renewable energy for use in the roofs and walls of buildings.

Delivering low-energy buildings with excellent in-use energy performance is a challenge. MCRMA members understand the factors that can affect the performance gap (the gap between the designed and expected and actual energy performance in the built environment) and how this can be minimised to achieve maximum as built performance. It is important to recognise that the 'pick and mix' approach to projects where non compatible systems and components may be brought together by some contractors can easily negate the benefits of an energy efficient design. Whilst the installer may be tempted by the cheaper option, the ultimate responsibility for meeting the performance specification should remain with the designer and the client. Working with a main contractor and manufacturer who understands the risks and the value of a specification should not be underestimated.

The best assurance of compliance to meet sustainability targets is to source systems and products from reputable manufacturers who can demonstrate the pedigree of the materials used and support design requirements with job specific data. We should also be mindful that even a well-designed building system will fail to comply with the regulations if it has not been properly installed by trained, experienced and supervised contractors.

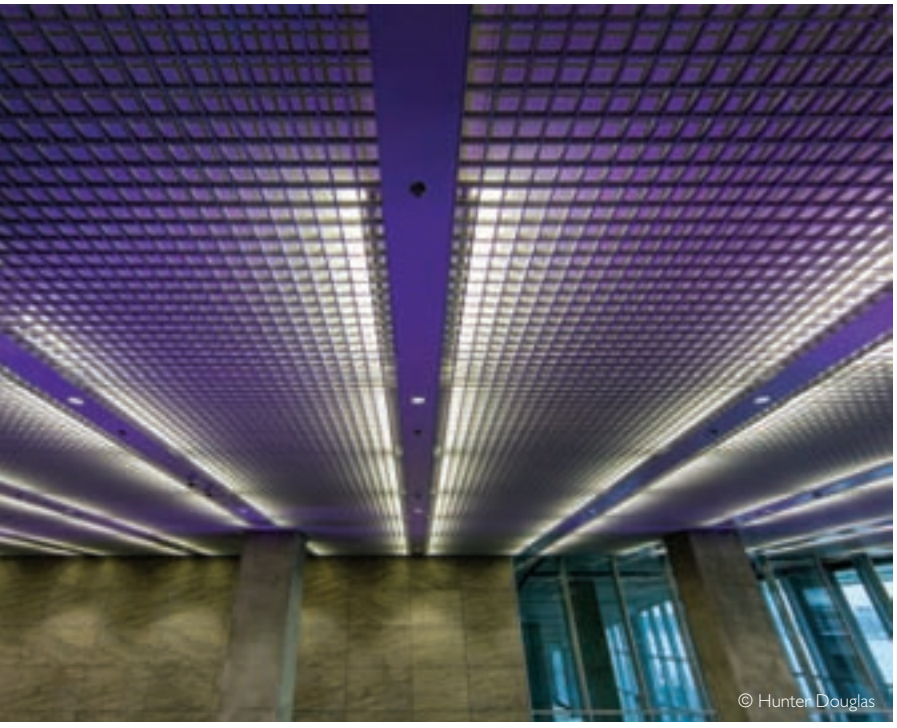
Manufacturers are best placed to offer advice about their particular products and MCRMA member companies can advise on the suitability and performance of their materials, systems and assemblies for specific applications. Additional project specific advice may also be obtained from one of the independent roofing and cladding inspectors featured on the MCRMA web site at www.mcrma.co.uk.

Metal in Architecture showcase

Setting new architectural standards, the highly complex Waveform Tubeline System supplied by SAS International allowed the architect's vision to come alive. Spanning two curved glass pavilions externally and internally, the ceiling forms a distinctive, highly-visible feature, only made possible by testing the design brief against the various site constraints and exploring the manufacturing process through a series of mock-ups.

Left: Perforated metal sunscreens can help reduce the environmental impact and footprint of a building – a common goal for architects. Adding a perforated metal facade goes some way to fulfilling this objective, and any cost incurred in the installation can be recouped during the life of the building as energy bills decrease.

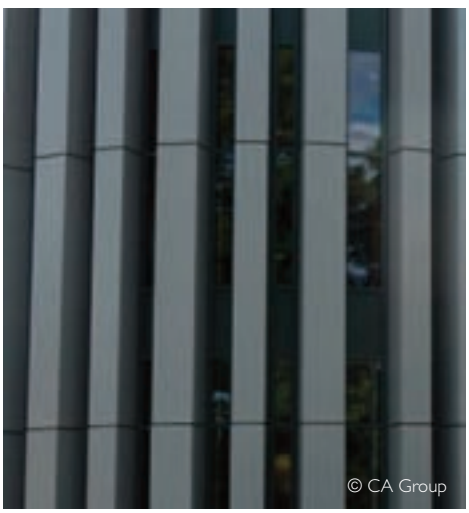
Right: Commonly used materials for metallic sunscreens are stainless steel, copper and aluminium with the latter being most popular. Aluminium is easy to recycle, lightweight to install on a structure, and involves very little maintenance while meeting environmental requirements, as it can be manufactured economically and responsibly.



Hunter Douglas has developed a unique, custom-made 2,500m^2 ceiling for the entire ground floor of the Netherlands' largest multifunctional building, 'De Rotterdam'. The ceiling consists of two layers: a panel ceiling with a high light reflection value and a grid ceiling beneath it. In between are luminaires with fluorescent tubes, allowing light to bounce off the reflective surface and spread into the interior of the building.

VMZINC Pigmento Red on a standing seam facade at Kingsland Wharves in Hackney, East London. Located within the Kingsland and Regents Canal Conservation Areas, the mixed use, waterside development is on brownfield land around Kingsland Basin and comprises 207 apartments, a health centre, artists' studios and a waterside cafe.

SAS International has supplied 57,000m² of System 330 tartan grid and bespoke triangular panels to 47 floors of the Walkie Talkie. The bespoke triangular panels feature a large half and half continuous special perforation for aesthetic quality and acoustic performance. The special perforation used for the North Core then became a standard across the rest of the shell and core.



The addition of CA Group's Prime Rainscreen at Middlesbrough Fire Station has transformed the appearance of the new community base which is due to officially open in the autumn. The refurbishment incorporates a castellated feature wall which has been capped to provide a fully weathered solution.

Continued overleaf...

The Institute for Sustainable Design features a unique twin-wall facade featuring AluK aluminium curtain walling systems. The bespoke double skin facade extension provides additional 657m to the Grade II listed former Central Library building, and was designed to be as transparent as possible to express the original scale and features of the historic fabric behind. The facade created a truly sustainable solution, to both reduce energy consumption and create an inspiring place to learn.


© AluK


© Metalline

Metalline has received top marks for the external facade of the Kensington Aldridge Academy in North Kensington, officially opened in January 2015 by the Duchess of Cambridge. Designed by architects Studio E, the BREEAM Excellent rated building features over 2,000 panels in varying lengths and depths up to 4,500mm and 800mm respectively, finished in four different RAL colours The company also supplied a range of ventilated Birds Beak style panels, pressings, copings and cills that further added to the overall aesthetic of the building's facade.


© Wicona

Riverside East is the new landmark administrative headquarters for Police Scotland, providing Grade 'A' office accommodation for more than 1,000 officers and civilian staff. Designed by Cooper Cromar Architects, the scheme has a bold and transparent appearance, created using around 5,000m^2 of Wicona's WICTEC 50 structurally glazed curtain walling allowing impressive waterfront views. More than 1,600m2 of structural glazing were also used for the internal atria using the WICTEC 60FP system to deliver a 30-minute fire rating.

Building envelope specialist, CA Group, has completed work on a major distribution centre for H&M. The warehouse showcases the company's latest innovations in cladding with the introduction of a graduated green facade which gives the warehouse its distinctive look.


© CA Group

European Copper in Architecture Awards

The previous, 2013 Awards Winner in Guimarães, Portugal, designed by Fernando Sá (one of the 2015 judges), Pitágoras Aquitectos Photo: João Morgado

An international team of architect judges has shortlisted ten projects for the 2015 European Copper in Architecture Awards, a celebration of the very best in contemporary architecture. By Chris Hodson

The seventeenth iteration of these popular, biennial architectural awards recognises the growing influence of copper and its alloys on modern design. But it also exposes to a wider international audience inspirational projects, some of which might otherwise go unrecognised. This year, over 50 entries were received from 17 countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Poland, Portugal, Russia, Spain, Sweden, Switzerland and the United Kingdom.

Diversity of projects

Entries demonstrated a real diversity of projects, ranging from major landmark buildings to modest installations. All the projects incorporate cladding, roofing, or other architectural elements of copper or copper alloys but, as always, judging was essentially based around the overall architectural qualities of the projects. They were assessed from photographs, drawings and descriptions submitted by their architects.

This year's judging panel consisted of four architects: Ulla Hell (PLASMA studio, Italy); Erik Nobel (NOBEL arkitekter, Denmark); Fernando Sá (Pitágoras Aquitectos, Portugal) and Keith Williams (keith williams architects, UK). All have been recipients of previous Copper in Architecture Awards and therefore understand the aims of the programme from the competitors' viewpoint as well as that of the judges and the sponsors.

Chair of the Judges, Keith Williams commented: "Whilst there was a considerable degree of unanimity amongst the judges, there was also considerable debate. Neither the scale of project nor the quantity of copper used was regarded a factor, as is evidenced from the range of projects shortlisted. The judges were far more interested in the contribution that copper and its alloys can make to the creation of fine architecture."

Continued overleaf...

'The judges were far more interested in the contribution that copper and its alloys can make to the creation of fine architecture'

Alps Villa in Lumezzane, Italy © Niccolò Galeazzi

High Standards

The judges initially faced a daunting task and were impressed by the high standards demonstrated across the entries generally, with many examples of good buildings delivering their programmes well and contributing to their surroundings. But eventually they settled on the following shortlisted projects (described in summary by their architects) that stood out from the rest, revealing a real diversity of typologies and approaches, and impressive architectural qualities. Keith Williams added: "Arriving at the top 10 was far from easy and all those shortlisted have produced exceptional work."

Alps Villa, Lumezzane, Italy, designed by Camillo Botticini Architetto

The house stands on a steep slope, amongst trees, 700 metres above sea level. The materials of the project create a relationship between the plot and the landscape. The house seems to bite into the mountain: it is deep-rooted to the north and "emancipated" to the south, through an overhang that turns the house to the valley.

The plan of the house is C-shaped with a patio, and irregular. The fourth side is defined by a green level area that creates three forms with variable heights, increasing from north-east, where the volume disappears, inserting itself into the ground.

The green meadows and trees frame the external skin made of corrugated pre-oxidised copper and Accoya wood. The copper, timber and triple glazing of the windows provide a counterpoint that interacts with nature. The ventilated copper wall is modulated with a slight pleating, its non-reflective surface almost quivering in the light, while the timber of the great splay reflects southern light.

Great James Street, London, designed by Emrys Architects

32-33 Great James Street comprises two Grade II* listed, five-storey terraced townhouses built between 1720 and 1724. The office accommodation was outdated and poor quality. The solution was to retain and enhance the grandeur of the terrace and to introduce an entirely new structure in the tight, landlocked space to the rear, creating a dramatic transition from the old to the new.

Great James Street, London, UK © Alan Williams

A copper alloy bronze triangulated roof form sits over this area – its height and form designed to fit key points around the perimeter. In order to maximise the potential of the space and introduce drama, certain elements of the roof shape were pulled upward increasing the internal floor-to-ceiling heights. The patina of the bronze on this contemporary folded roof, as well as courtyard facades and window surrounds, was selected to harmonise with the existing buildings. An asymmetric lofted ceiling sits under the new roof with recessed lighting accentuating the geometric planes. Use of roof lights and glazed access to courtyard areas has ensured that the building is flooded with light.

Ferry Terminal Buildings, Stockholm, designed by Marge Arkitekter

The buildings serve travellers heading to the Stockholm archipelago and are located in one of the city's most visited areas opposite the Royal Palace. There are three new buildings: two terminals and one building with a cafe, viewing steps, storage and a recycling station. The buildings are scaled down in relation to the surrounding architecture, maintaining open views of the Royal Palace. The design is based on an elementary form – the cone – framing different views over the water. The cones are combined in different ways to meet the demands of the different operations, resulting in buildings with no specific fronts or backs.

Each building is unique but together they create a cohesive expression for visitors. Exterior facades are covered with burnished brass alloy, accentuating the sculptural form of the buildings with a gradually evolving surface. Glazing by the waiting hall and the sales areas is drawn back to give rain shelter and to provide space for displays. Due to the construction of the buildings a precise expression has been created where guttering and drain pipes can be avoided.

Ferry Terminal, Stockholm, Sweden © Johan Fowelin

Museum Of The Franco-Prussian War Of 1870 And The Annexation, Gravelotte, France

Museum of The Franco-Prussian War of 1870 and The Annexation, France, designed by Bruno Mader Architectes

Monolithic, the new Museum sits quietly in the village of Gravelotte, looking towards the former battlefields. However, it is powerfully differentiated from its surroundings by materiality, affirming its identity. Clad in patinated brass, the building marries a simple plan form with irregular rooflines. The roof folds along east-west axes, creating a dialogue of slopes and fragmenting the volume.

These folds – steps in the roof like steel blades – are gashed with glazed openings to capture the north light. The light coming through the irregular saw-tooth roof illuminates a central double-height entrance hall space in such a way that it feels neither interior nor exterior.

This focal point is a dramatic space, whose dark, irregular walls and lacerated roof are an architectural interpretation of what is represented by war. The huge panels of patinated metal that form the hall's walls are the same as those used on the facades, providing the building with a powerful identity, coherence and sculptural character.

Continued overleaf...

'The judges initially faced a daunting task and were impressed by the high standards demonstrated across the entries'


Euravenir Tower, Lille, France © Julien Lanoo

Euravenir Tower, Lille, designed by LAN

The Euravenir Tower project occupies the last free parcel of Phase One of the Euralille Area. The plot's strategic position, located at the intersection of different axes, demanded a sophisticated solution that acts as a hub, uniting the elements gravitating around it. By extending and crossing the axes within the plot, an initial extrusion generated a small tower. By completing the Avenue Le Corbusier, this vertical element is also a corner building on the Place Valladolid signalling the city to approaching drivers.

This architecture has created a new urban space that combines private and public, vertical and horizontal. The facades become a series of windows that provide a 360-degree panorama of the city. Here, a lattice motif is formed by cut-outs in the facades. The copper is used as a kind of fixed edge along the opaque or semi-glazed stretches of the facade. It is also present in the form of perforated panels that help regulate the amount of light penetrating the building.

Rhone Department Archives, Lyon, designed by gautier + conquet & Associes

The unusual site location between the TGV rail tracks – linking Lyon with the rest of Europe – and an urban boulevard, allows the city to fully exhibit its collection. The building must reconcile the need to protect the collection while welcoming the public, encouraging them to enter and engage with its knowhow, as part of the urban and cultural process. The technical challenge is to supply air with a highly stable level of humidity whilst maintaining low energy consumption.

At a city scale, the project forms three 'beautiful boxes', housing other boxes – the archive conservations rooms, in turn full of still smaller boxes – the archives themselves. The cubic volumes are made up of precious materials: stone, a golden copper alloy and glass. The central layer encloses the archives with copper alloy embossed panels that give the surface its texture. The top layer contains the offices, behind a ventilated double skin glass envelope, like a lid on a precious casket.

Sports Hall, St Martin, Austria, designed by Dietger Wissounig Architekten

At the front of the elongated structure is the main entrance with a small forecourt. The three-storey building has been lowered four metres below street level in order to create a direct underground access to the adjacent school and to give the extensive hall with a total height of 11.8 metres an appropriate form in the locality.

The building's appearance is characterised by a facade made of folded, perforated copper plates covering the hall like a semi-transparent veil. The copper sheets are staggered by one folded element at each storey, which structures the front horizontally. The facade is interrupted by glazing on the upper floor at the northeast side and on the ground floor at

Archives départementales, Lyon, France © Renaud Araud


Sports Hall St. Martin, Austria © paul-ott

the southeast side. The former ensures an even and glare-free incidence of daylight in addition to the numerous skylights, while the latter provides a view into the sports hall from the schoolyard.

Kunstmuseum, Ahrenshoop, Germany, designed by Staab Architekten

A deep bond with the landscape and the local traditional buildings can be felt both in the works and homes of the Ahrenshoop artists' colony. The design concept for the project represents reinterpretation of this vernacular typology into a modern museum structure. Emerging from thatched-roof houses, a constellation of single-room buildings has been developed based on the particular sizes of the actual exhibition rooms. By fusing the roof forms, a sculptural building volume is generated that unites these apparently freestanding structures into a single complex.

The facade is one of the outstanding features of the building. For the external skin, bevelled brass sheets refer to the linear texture of reed thatching. The brass will quickly weather to give a darker surface reminiscent of thatched roofs. The desired surface irregularity was achieved using subtle variations in the profiles and the product develops an unexpectedly varied look.

Trollbeads House, Copenhagen, designed by BBP Arkitekter

A 1960s office building has been transformed into a high security building, organised like a Venetian merchant house, with goods loaded at the ground floor, stock and offices above, and, at the highest level, a residence for the owner with a roof terrace. The challenge was to make a building that respects its curtain wall typology, while relating to the historic houses on either side.

A new skin of glass and brass covers the facade, the roof and a small courtyard at the back. On the outside a patterned, perforated brass curtain is hung, incorporating motorised folding elements. Every morning half of the curtain opens, emulating the adjacent historic houses with repeating window

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Kunstmuseum, Ahrenshoop, Germany © S Müller


A modern merchant's house, Copenhagen, Denmark (Trollbeads) © Jens Markus Lindhe

reveals in a 'massive' wall. After working hours the curtain closes automatically, creating a burglar-proof vault. After dark, dim lighting reveals a modern glass house behind a veil of translucent brass.


House VDV, Destelbergen, Belgium © Filip Dujardin, www.filipdujardin.be

House VDV, Destelbergen, Belgium, designed by GRAUX & BAEYENS architecten

House VDV appears simultaneously familiar and strange. The basic volume, consisting of a ground floor and upper level within a pitched roof, alludes to familiar archetypes such as the rural farmhouse or barn. Yet, at the same time, the simplicity of the volume is broken up by large glass facades, establishing relationships with the surrounding trees and listed castle wall surrounding the plot.

Mandatory planning requirements for the plot made sure that the house was conceived as a pavilion. The solution is essentially a garden-house with no front or rear but, instead, two identical facades and a 360-degree experience of the entire plot. The untreated copper cladding will continuously change colour over the years, from bright in the beginning to brown and eventually green at the end. It gives the project a poetic impermanence, which is echoed in the reflection of the surrounding trees in the glass facades.

The Overall Winner, Commended projects and Public Choice Award will be announced later in the year. More information and images of the shortlisted projects, all the other entries and previous Awards can be viewed at: copperconcept.org/awards

Nordic Bronze. *Project: Ferry Terminal Buildings, Stockholm; Architects: Marge Arkitekter; Photo: Johan Fowelin*

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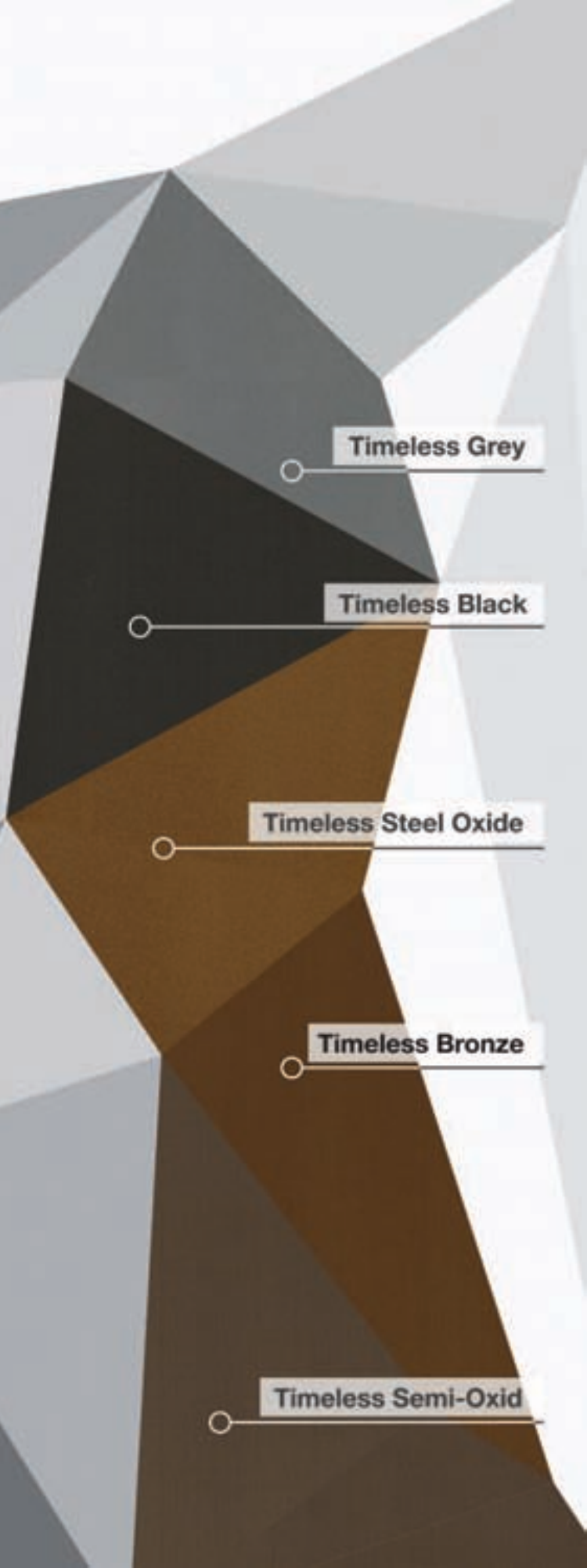

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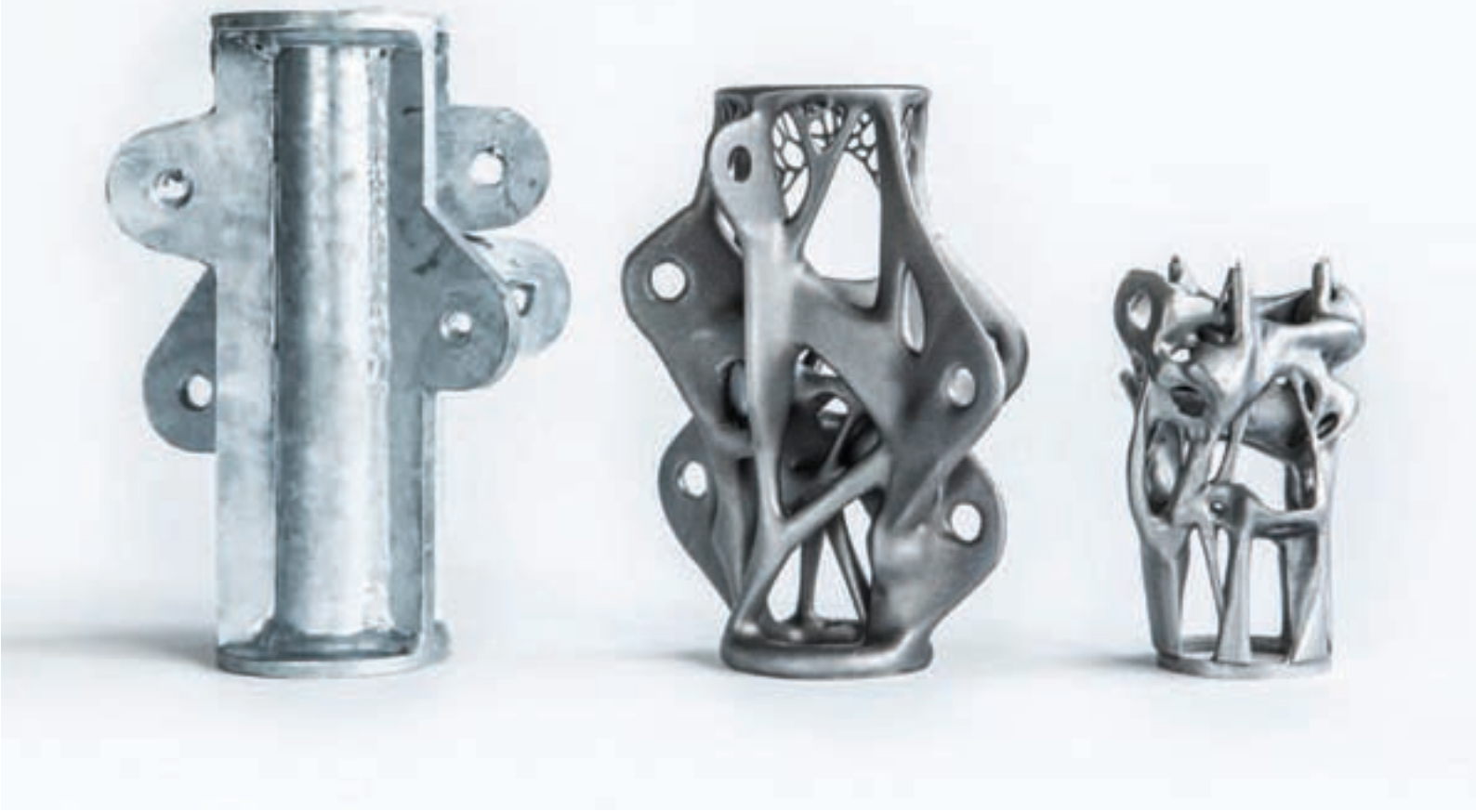

3D printing shows its metal

Research into 3D printing using metal has produced the world's first complex steel components and plans to print an entire steel bridge in mid air using automated robots. Stephen Cousins reports

The large scale application of 3D printing, or additive manufacturing, on construction projects became a reality last year when the little known Chinese firm WinSun announced it had 3D-printed 10 concrete houses in a day.

The firm also used the same technique, using a printer head on a massive gantry to pump out a mixture of fibreglass, steel, cement and binder, earlier this year to build a 1,100 sq m villa and a five-storey apartment building.

Less well publicised, but arguably equally as important to the building industry, have been recent developments in the use of 3D printing in metal. Engineering consultant Arup has led a project using direct laser sintering (an additive manufacturing technique using a laser to sinter powdered metal, binding the material together to create a solid structure) to create geometrically complex building components, while the R&D start up MX3D has led a team developing computer-controlled robots fitted with welding arms designed to 3D print entire steel structures.

3D printing in tough metal alloys, like stainless steel, or maraging steel, provide an opportunity to optimise common building components such as beams, columns, metal cladding or roofing, speeding up production, reducing waste and improving quality compared to traditional manufacturing techniques.

Salome Galjaard, an additive manufacturing expert and senior designer at Arup commented: "I would not be surprised if, in five to 10 years' time we regularly see 3D printers, using metal or other materials, in factories or on construction sites. When you consider that many major projects starting up now will be on site around then, it is important that designers take this technology into account and keep an eye on any new developments they might utilise."

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A bridge too far?

The MX3D-led team of researchers in the Netherlands is innovating a new 3D printing methodology, based on conventional welding techniques, that will see two automated robots construct an entire steel bridge over a canal in Amsterdam, without direct human intervention.

The R&D project is being carried out in collaboration with major industry players including software firm Autodesk, construction firm Heijmans, ABB Robotics and computer maker Lenovo. The project is being billed as the start of a revolution as digital fabrication enters the world of large scale, functional objects made of durable material.

The team is currently consulting with the City of Amsterdam to determine where the bridge will be located and construction is due to start in Spring 2017.

The two single-arm industrial robots, supplied by ABB, have been modified to incorporate multi-directional welding nozzles, and will effectively 'draw' the bridge underneath them in "mid-air" using advanced software to guide them from one bank of the canal to the other.

The 3D printing technique is a form of welding, using small amounts of molten steel, added to stainless steel to fuse them together. As consecutive layers are built up, a solid and robust monolithic structure is formed, eradicating the need for support-structures.

Unlike laser sintering methods of additive manufacturing, which must be carried out in a controlled factory environment, this welding technique should enable construction in the open air, potentially ushering in a new era for construction.

Tim Geurtjens, CTO at MX3D commented: "The technique could have big implications for the world of construction, and theoretically one day we will be able to print structures anywhere the robots are able to go. However, this is a development process and the technology is not there just yet. If we want to print the bridge outside, we will have to protect it from the wind, otherwise the shielding gases, used during welding, would just blow away. We still have to figure out a way to do that."

The intense light produced when welding is another concern, and a potential hazard to bystanders, so construction may have to take place over a canal in a secluded part of the city, away from crowds. "We hope we can use the robots live at the location where the bridge will stand, but that will depend on where it is, if it is too busy we might consider printing off site where there are fewer people, then move the completed structure into position."

The team is is currently carrying out software development work to enable the system to upload 3D models and translate them into a printing strategy and a language that can control the robots. A new test facility, in a large shipping wharf in the north of Amsterdam, will open at the end of September.

According to Geurtjens, detailed strength calculations must be carried out to ensure the bridge is able to support its own weight and that of the robots riding on top. However, he says in general strength is not a concern as the molten material solidifies and cools down fast, and just one minute after printing it is able to support a full load.

"The main challenge is ensuring the robots know their position in space, from one moment to the next, and in relation to the bridge as it is being printed," he said. "A significant aspect is the design for the robots' propulsion system. We are currently looking at either a wheel or track system, or a system using special grips able to move the robot forward one position at a time as welding progresses."

The bridge project started life over two years ago, when Autodesk came across a Youtube video of MX3D's new welding technique and, excited by the potential, flew to Holland to see what it could do. A subsequent meeting at Autodesk's office, in San Francisco, triggered the idea of printing a bridge to showcase what is possible using the technique, above and beyond printing smaller objects.

"Amsterdam is known for its canals and bridges, so a bridge seemed the logical step to take," said Geurtjens. "We now have different locations on our radar but it depends on what the City wants and what is practical, we need a location that is not too busy but also has the character of the Old City of Amsterdam."

Based on initial tests and printing speeds achieved, MX3D

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'Direct laser sintering has previously been applied...but only recently has construction started to explore the possibilities'

predicts construction/printing time will take around three months. The final design for the bridge should be complete in about a year's time.

The direct approach

Direct laser sintering has previously been applied by industries including automotive, aerospace and healthcare, but only recently has construction started to explore the possibilities.

Earlier this year, Arup completed the second phase of research into using the technique to print complex steel connections, more efficiently than using traditional tecniques.

The collaboration, with design software company WithinLab, 3D printing specialist CRDM/3D Systems and 3D printing manufacturer EOS, focused on the production of 1,200 intricate steel "nodes" for a proposed street lighting scheme in the Netherlands. The pioneering research, led by Salomé Galjaard, senior designer at Arup, was funded when the construction project was put on hold.

The nodes form part a lightweight steel structure of angled struts, tension cables and lighting attached to the sides of buildings along a main street. The complexity of forces at work meant that each node, though similar in design, had to be produced using a unique geometry.

Under the original design, each node would have been cut and welded individually by hand, but phase one of Arup's research demonstrated that, by designing the nodes for production using direct laser sintering, they could be formed faster, to higher quality standards and with less wasted material.

"The original design required a lot of similar, but not identical, products to produce the 1,200 nodes, whereas it should be cheaper to have one repeated element. I thought 3D printing could help," said Galjaard. "Instead of making one mould that produces the same products over and over, a 3D printer builds everything from scratch and you can easily make small changes to the design."

Through a process of topology optimisation, design software was used to precisely calculate the volume and shape of steel needed to support the applied loads in the structure. "The original node design had a lot of material not really doing anything and traditional production techniques require a great deal of effort and expense to remove it. By building from scratch, using additive manufacturing, it's easier to only include material where you need it," said Galjaard.

Phase two of the project further optimised the design by integrating other street lighting components into the 3D printed node structure, including a pin and fork connection and a spanner, used to control tension in cables connected to the node.

This rationalisation helped reduce the overall weight of the structure and eliminated a total 15,000 products from the overall scheme, reducing costs related to their purchase, shipping, installation and maintenance.

Whether using 3D manufacturing would reduce overall costs on this scheme is harder to determine, explained Galjaard: "Cutting and welding steel plates and tubes is not a smart or a cost effective process, but on the other hand, 3D printing costs are also still very high. However, if you consider the entire lifecycle of the product and its impact on the structural system, cost reductions are most obvious."

Arup's latest 3D printed nodes are 75 per cent lighter than the original design, which meant the weight (and therefore the cost) of the rest of structure, including the cables and struts, could be reduced. In addition, the optimised design cut tension and compression in connected components by 20 per cent, meaning thinner cables and tubes could be ordered. "In total, there were 15,000 fewer products to order and install, and less interfaces between components, meaning reduced ongoing maintenance costs," said Galjaard.

Currently, the Arup team is looking for a real world project to apply its learning to, potentially an art installation, or a small building or structure with relatively small, complex 3D parts suitable for 3D printing. Applications in other industries might also take the technology forward, added Galjaard: "It might be rigging for a sailing boat, I get a lot of calls from the oil & gas industry hoping this is will be a solution to some of their problems. Working on a different application can lead to the discovery of new benefits of techniques you hadn't considered before," she concluded.

Why metal gutters are the popular choice

The Metal Gutter Manufacturers Association (MGMA) explains why metal gutter systems are growing in popularity.

If you are looking for a rainwater system that really performs and stands the tests of time, metal systems should be the first choice. Although metal systems will often require a bigger budget, they display quality and will outlast and outperform other products such as uPVC.

Metal rainwater drainage systems offer excellent 'life time' value. With specifiers increasingly looking at the whole-life cost of their projects, especially those with self-build schemes where clients are also looking for individuality and low maintenance solutions, metal systems provide exceptional value for money and design solutions that cannot be matched by other materials.

Metal rainwater systems offer an unrivalled ability to cope with extraordinary weather – materials are strong, gutters can be deep with larger holding capacity and improved flow rates, metals expand and contract much less than uPVC systems, which have to include joints to allow for thermal movement. All these features mean a greater ability to cope with and endure our increasingly volatile weather conditions.

Importantly, metals also represent the most sustainable, environmentally friendly building materials due to their longevity – avoiding the use of more resources and their recyclability – saving further landfill space.

The metal rainwater industry has a long history in the UK market dating back over a century when lead and cast iron were the materials of choice. Today the industry uses the latest in manufacturing technology to produce a wide variety of high quality solutions in cast aluminium and iron, fabricated steel and aluminium.

The choice of materials and designs available in metal rainwater products have grown rapidly in recent years with the introduction and availability of high performance, pre-painted metal systems giving clients and architects confidence in the quality of finish and providing the installer with pre-finished systems that are easy to install.

Steel

Steel is smart, stylish and contemporary and offers a value for money option. Its modern look and flexibility of colour finish means it can add style to a contemporary building and looks equally effective on traditional properties or in commercial applications.

Steel is light weight and easy to manage but stronger and more durable than uPVC. Installed it offers a robust rainwater disposal solution with a manufacturer's guarantee of up to 15 years, although with sensible maintenance, life expectancy should be more like 25 years.

Image courtesy of Alutec
Cast iron rainwater system installed at Centre for Islamic Studies, Oxford University

Finished in either plain galvanised, powder coating or pre-painted, steel can come in a variety of colours giving aesthetic flexibility and choice.

Extruded and pressed aluminium systems

Modern manufacturing processes produce extruded and pressed aluminium systems that are long lasting, highly efficient and a cost effective, quality option. Aluminium is highly durable and requires minimal maintenance, which is another great benefit in our changeable climate. Pressed and extruded aluminium systems offer an economical solution when compared to traditional, thicker cast aluminium and should last in excess of 25 years.

These systems are available in a wide range of profile and coatings to suit all types of building. From half round, vintage moulded ogee, Victorian to contemporary joggle box profiles, all available in a factory applied powder coated system to any RAL colour.

Gutters are generally available in large profiles so this material also works well on light commercial and industrial buildings as well as residential projects.

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Image courtesy of Hargreaves Foundry
Example of galvanized steel installation

Cast aluminium

Traditional cast aluminium is authentic, extremely robust and long lasting. It is lighter in weight and so easier to install than cast iron, but heavier than modern fabricated aluminium. Cast aluminium is made using traditional die casting methods; it is for these reasons that it is has a price tag towards the top end of the price range. However, it offers an ideal option for a quality project or the perfect alternative for a traditional property where cast iron is not a requirement.

Cast aluminium now comes in a wide variety of profiles which look great on a range of projects, traditional and modern. Available powder coated to any RAL colour, it offers great choice, comes ready for immediate installation and requires minimal maintenance.

Cast iron

Cast iron offers an unrivalled life span compared to all the other materials. It is immensely strong, will look superb on traditional style properties and is a must for listed properties and historical renovation projects. Although the most lavish material for guttering, it should last at least 50 years with the correct maintenance, with many systems lasting 100 years plus.

Cast iron guttering now comes in half round, Victorian ogee or moulded ogee profiles with round and square downpipe profiles to match. It is available in a primer coat for painting on site or a pre-painted finish for direct installation. Cast iron is the heaviest of the materials and although installation is easier than ever before, a cast iron rainwater system needs to be professionally installed.

Where a unique style of gutter, downpipe or hopper head is required, bespoke designs are available from specialist foundries to create the products necessary to match a historic or tailored system.

For further information about metal rainwater systems visit the web site at www.mgma.co.uk.

Rolled Lead Sheet – spanning the centuries

Richard Diment, Chief Executive, Lead Sheet Association, discusses how a traditional material successfully bridges the gap between old and new

It is always satisfying to see a tried and tested traditional material finding modern uses. Rolled Lead Sheet has been around for hundreds of years, and it has been used just as much for its aesthetic as well as practical uses.

With its admirably long life span – no problem specifying for a 60-year life or more – it is also an impressive material with great malleability that can wrap itself around many buildings in a way that more rigid modern products cannot.

Add to this British Standard Rolled Lead Sheet's green credentials – a BRE Green Guide rating of A+ and A in vertical cladding and roofing applications – and it appears a much more contemporary building product.

It also has the aesthetic qualities to bridge the gap between old and new rather effectively.

Old meets new in Great Yarmouth

In the seaside town of Great Yarmouth, what was once one of the finest Baroque churches in the country, modelled on St Clement Danes by Sir Christopher Wren, fell into disrepair in the 1970s. It lasted as a theatre until 2006 but was then closed.

The building was rescued, in part with funding from the Heritage Lottery Fund. What exists today is a masterful blend of the restoration of the old with the new, with the Grade I listed Chapel restored, repaired and redeveloped to provide a flexible new performing arts centre and community space. Adjacent to it, a new pavilion building accommodates the front-of-house activities and service functions that could not be accommodated within the church. Between them, St George's Plain serves as an external foyer and performance space.

Hopkins Architects began work in 2009, with the project completed in 2013. The new pavilion provides a wonderful echo to the old Chapel with lead central in providing a link between the two buildings.

As well as echoing the same brickwork, the pavilion's roof is finished in the same Rolled Lead Sheet as the beautifully restored theatre in the Chapel. The rounded ends of the new building joyfully reflecting the rounded portions of the old Chapel.

Norfolk Sheet Lead was responsible for the installation on the build, using Code 6 lead to replace a defective copper roof on the main building (which was not original) and using the same grade on the new pavilion. The roof on the pavilion also has a ridge vent detail in the leadwork to air the timber structure beneath.

The new pavilion at St George's Theatre © Hugh Pearman

The reworked public space around both buildings provides an oasis for the public with traffic-calming creating an effective public space.

A London landmark restored

Rolled Lead Sheet has played a key role for many centuries and it had lasted well on The London Oratory, a distinctive London landmark in South Kensington. This neo-classical Roman Catholic Church and a Grade II listed building located on Brompton Road was constructed in the late nineteenth century.

It boasts some fabulous examples of Italian architecture designed by Herbert Gribble, with perhaps the most striking feature externally being the large Baroque dome. The leadwork on the dome, originally installed in 1895, performed excellently for well in excess of 100 years, with only minimal maintenance being required in the meantime. This was yet another fantastic example of the longevity and quality of rolled lead sheet.

However, after some 117 years it was decided that a major refurbishment of the leadwork on the dome was necessary. The rolled lead sheet was finally showing signs of fixing fatigue and crystallisation, with minor signs of underside corrosion, and so

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the decision was made for renewal of the leadwork, which was undertaken by Martin (UK) Roofing Systems.

An aerial view of the Baroque Dome at the London Oratory

This was a complex job, which included the use of extensive scaffolding and ensuring each section was renewed to the same specification as that it was replacing. Using Code 6 on the ribs and Code 7 on the main body of the dome, approximately 57 tonnes of British Standard Rolled Lead Sheet was installed. Although ventilation was successfully incorporated into the structure at the time of original installation, as indicated by the absence of underside corrosion for over a hundred years, additional high-level ventilation was introduced within the ornate head of the lantern.

With the assurance of having had British Standard Rolled Lead Sheet fitted by award winning leadworkers, the London Oratory can be confident that the leadwork will last at least another 100 years before requiring further attention and so will leave the building in good shape for future generations.

Support for the future

These are just two examples of Rolled Lead Sheet playing a starring role in some of this country's most stunning architecture – from centuries old to the new, blending successfully with a modern approach.

The LSA also provides technical advice to architects and specifiers, to find out more about how we support the construction industry and can help you visit www.leadsheet.co.uk.

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Bespoke Iron Castings

The principles of iron casting are pretty much the same as they have been for centuries; the technology, skills, materials and understanding have all progressed. Michael Hinchliffe, managing director, Hargreaves Foundry, gives us his view

Something foundries hear all too often nowadays is "Oh we didn't know anybody could make those any longer". Well that just isn't true. Modern foundries are probably better iron casters than our Victorian forebears and anything they could make we can make.

What is a bespoke casting?

Bespoke castings may be one-offs or multiples, but they are generally unique to a specific project or building. Many bespoke castings are manufactured for Heritage or Restoration projects; however bespoke castings can be made based on new designs as well. It doesn't really matter what the shape or size, whether an ornate rainwater head, a radius gutter, or a large column, it can still be made in cast iron.

What products are made in cast iron?

Cast iron features strongly in our built environment, both traditional and modern. Well known products are: above and below ground drainage, street furniture, lighting standards, railings, columns, manhole and storm drain covers, window frames, pavement lights, decorative features such as urns, pergolas and water features – the list goes on. There are literally thousands of products made of or featuring component parts in cast iron.

How are castings made?

Briefly, a pattern of the item required is made. Patterns are traditionally made of wood and are an exact model of the finished product. Patterns are encased in sand moulds, which, when set, allow the pattern to be removed leaving a cavity into which molten iron can be poured at 1,350°C. Once cooled, the casting can be shot blasted and finished in a process known as fettling, ready to be painted.

The skills required for these processes, pattern making and moulding, are traditional craft skills and require a high degree of training, expertise and hand skill. That's not to say that things aren't changing, especially in pattern making. In some cases, CAD files handed on directly from architects can be used to mill patterns out of model board. Some smaller patterns are now being made using digital printers. However, to be able to make this work, designers or programmers need to work closely with people who have a thorough understanding of pattern making, foundry process and casting iron in sand moulds. Without allowing for metal shrinkage, knowing how to add taper so that patterns can be removed from moulds and how to design a method system that allows metal to flow into the mould and gases to escape, you won't be able to produce a casting either precisely, or more importantly, safely.

Is cast iron still relevant to the architecture of the 21st Century?

Well, I'd say a resounding yes to that, and not just for heritage products. And we can prove it. Just look at One Pancras Square featuring 396 bespoke cast iron columns with a basket weave design, all of which were made entirely from recycled scrap iron. This is a modern, award winning building designed by David Chipperfield Associates, which also achieved a BREEAM rating of outstanding with a score of 89.3 per cent. And therein lies another critical benefit of cast iron – its sustainability. Cast iron can be recycled indefinitely without any decline in its properties. Foundries have always recycled scrap iron, it is after all cheaper with no reduction in performance. It is important to stress that this is genuine recycling, not down cycling where products can be re-used but have inferior properties compared to their original usage.

Another benefit of cast iron is its longevity and value. Cast iron products are legendary for their durability and long life. Never mind a ten year builders' guarantee, properly maintained cast iron products will last the life of a building. Not only that, but when the building has served its purpose and is eventually demolished, the cast iron can be recycled and used again for exactly the same purpose. Given how important sustainability is to architects when designing new buildings, cast iron makes a strong case for inclusion, whether for structural products, decorative features or purely functional products such as drainage.

So, if you want to include cast iron in your projects, you can be confident that there are still foundries that can make them for you and will be happy to demonstrate that they are every bit as skilled as their Victorian counterparts.

Pattern for decorative Rainwater Head in wood and resin

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Stainless steel – sustainable, light in weight and affordable

Beyond the highly polished finishes associated with stainless steel, the diversity of new colours and finishes and long-term performance benefits, illustrate its full potential. Kevin Jones, business manager, Aperam Stainless Steel Services and Solutions UK Ltd, explains

Among the many factors influencing use of metals in construction cost has, not surprisingly, been the greatest. The need for greater sustainability prompted the beginning of change but, for many, stainless steel is still considered expensive. A perceived lack of design scope through association with highly polished finishes has also limited it's specification. In both respects, however, development of new products has taken the metal to a new level, and this continues to be reflected in its increasing use.

The desire to use colour and texture to create distinctive facades has never gone away and more widespread use of zinc and copper owes much to the introduction of contemporary colours, textures and finishes which are now seen as affordable. Where once there might have been little or no consideration of aesthetics, scope now exists to put a visual stamp on design without loss of functionality or sustainability.

The same is now true of stainless steel for which a variety of colours and finishes are available, one of the best illustrations of how far it has come being English Heritage's endorsement of a material which, through weathering, takes on the natural patination similar to lead. While clearly wanting to encourage lead's continued use on historic buildings, it was considered pragmatic to approve stainless steel because of its appearance, long design life and corrosion resistance. Where metal theft continues to be a risk or lack of funds / insurance preclude lead's use, stainless steel offers the vital balance between retention of the visual aesthetic and long term performance. Being far lighter in weight and having a low coefficient of expansion, tray lengths can be far longer and the stress imposed on a roof significantly less. Unlike lead, stainless steel is not susceptible to cold working fatigue and can be installed and soldered at low temperatures. More importantly, it can be used in harsh environments which would preclude use of other metals.

Such developments are a world away from the highly polished finishes with which many specifiers still associate the metal. Dramatic facades such as that on the John Lewis Store and Cineplex in Leicester undoubtedly take the eye by reflecting the colour and changing light. A 34,000m^2 rain screen was commissioned in a mirror finish but to diffuse the large area into a series of smaller reflective surfaces the metal was 'pleated' at different scales. It is still highly smooth to such

Continued overleaf...

Galashiels Interchange building. This was built as part of the visionary scheme to rebuild the railway between Galashiels and Edinburgh, the UK's biggest infrastructure rail scheme other than Crossrail

Marks and Spencer and Wagama on the new Glasgow Fort retail complex

'Weight is of course a major consideration when designing any facade'

an extent that the finish is virtually self-cleaning. The exterior 'curtain' concept provided a distinct identity and has even been extended to such elements as matching screen curtains within the interior.

Low roughness can also be achieved with matt stainless steel and the choice of new colours and textures has created the opportunity to design contemporary facades and roofs which will surely in future become synonymous with the metal. Patterns include linen texture, lozenge and chequer pattern, fine bead-blasted and sand-blasted finishes and even the simulated appearance of leather.

Ferritic grades were developed to bring greater price stability through the omission of nickel and their introduction has removed the cost fluctuation which was also enough to preclude austenitic grades. This has also been achieved without adverse impact on technical performance.

Weight is of course a major consideration when designing any facade. Stainless steel installed as shingles is ideal for large facades such as those illustrated, as a finish such as 2K is highly smooth and polished. Cooper Cromar Architects described it as 'an elegant stainless steel-clad box' and indeed the frontage was designed to form a distinctive new entrance feature when approached from the motorway. At only 0.6mm thick it was also estimated to have saved around 18 tonnes in facade weight over an equivalent in zinc or copper. In terms of sustainability it also presents none of the attendant underside corrosion problems associated with other hard metals.

The design scope provided by stainless steel is seeing it used in diverse projects including transport infrastructure. Whether as a traditional standing seam or shingles, as in the case of a new transport hub building in the Scottish Borders, it provides a permanent, durable matt facade in what again was designed as a 'statement building'. Given the predisposition to consider stainless steel as uncompetitive against other metals, the most critical element in this particular project was that, by virtue of the weight of material used, it saved over £11/m^2 over anodised aluminium. Among the hard metals it therefore now ticks all the boxes.

Decorative stainless steel at Birmingham's Bullring

Notes from the Comar design team...

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Hot-dip galvanizing is worth its steel

Bob Duxbury, technical director at Wedge Group Galvanizing, one of the UK's largest hot-dip galvanizing organisations, explains just how the galvanizing process works, the technology behind it, and the financial and sustainable benefits of incorporating the finish into architectural design

Structural steel has been the material of choice within the architectural industry for decades, but whilst steel is both strong and versatile, it's also particularly prone to rust and corrosion. Which is why it's paramount that a finish is selected which will not only protect the steel from the elements, but is long-lasting too. For this reason, galvanizing has long been recognised as one of the most durable and cost-effective finishes on the market. It's flexibility can be demonstrated through the sheer range of projects it is used on, from affordable housing projects and airport expansions, through to RNLI Lifeboat stations and commercial buildings.

The initial stage of the galvanizing process involves rigorous cleaning of the steel with chemicals to help ensure that the steel is in the perfect condition to react with molten zinc, which includes removing all grease, scale and dirt. Commonly, the steel product is dipped into an alkaline or acidic degreaser, or even shot blasted, and is then rinsed thoroughly in cold water before being dipped into hydrochloric acid at room temperature.

During the next stage of the process, the product is dipped in a flux solution, typically made up of zinc ammonium chloride, and held in a temperature range between 65°C and 80°C. The final stage of this process removes the last traces of oxide from the surface and coats the product with a thin film of flux. Once the steel has dried fully, it's dipped in molten zinc at around 450°C, which is when the galvanizing reaction takes place.

The thickness of the coating is created when the metallurgical reaction slows down and it's this cooling down process which results in the bright, shiny appearance generally associated with galvanized products. It protects steel by forming a surface film which is insoluble in rainwater, and prevents moisture and oxygen reaching the steel itself. This makes it more robust than other coatings, which only bond chemically or mechanically, and it has the added advantage of fully coating the steel, inside and out.

Hot-dip galvanizing is often perceived as a more expensive method compared with paint or powder coating because of its high coating performance, but in fact it can prove a much more cost-effective option compared with other methods. Because painting a structure is labour-intensive, costs can work out to be higher when taking into account the need for regular maintenance visits, and repainting, to ensure that it remains at the required standard. The hot-dip galvanizing treatment, however, lasts up to 60 years or longer in the right conditions, and is undertaken in a controlled, highly-regulated factory, which means that labour costs are significantly reduced.

Edward Howell Galvnaizers worked with Luke Perry of Industrial Heritage Stronghold to galvanizing a 20 metre by four metre tree sculpture for Timbertree Academy

The process has not only proved popular in architecture because of its ease of application, cost effectiveness and long-term durability, but also because of its own inherent sustainable qualities. Treated steel needs no maintenance which means that the whole life costs of products protected by hot-dip galvanizing can be further reduced because there is no need for the expense, down-time, and sheer inconvenience of repeated applications.

The overall cost of protecting steel throughout its lifetime can depend on the cost and durability of the initial coating, including the cost of maintenance. Take two popular forms of steel protection as an example. The first is a method which

Continued overleaf...

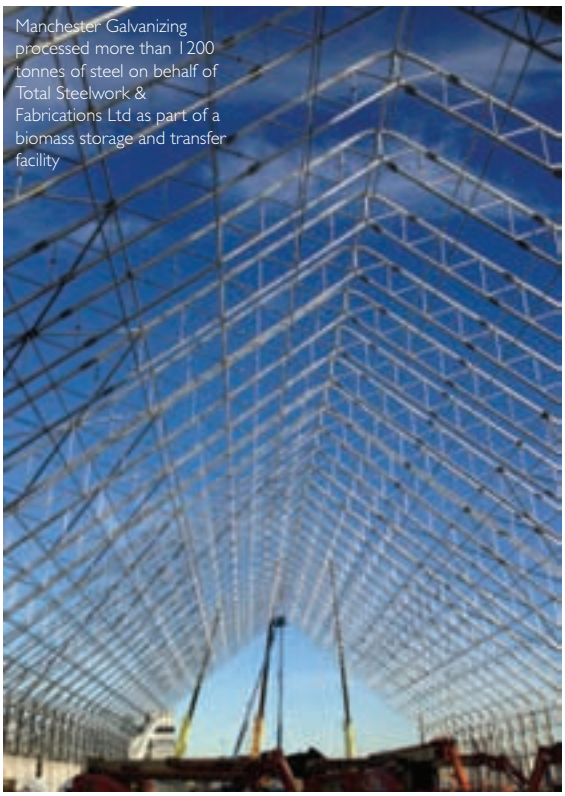
'The process has not only proved popular in architecture because of its ease of application, cost effectiveness and long-term durability, but also because of its own inherent sustainable qualities'

consists of cleaning, with an undercoat plus two coats of paint, and the second, a method which consists of blast cleaning and using three coats of paint.

Although they may last years with some maintenance, both are expected to need repainting twice over a 25 year period. And even the cost of a 'cheaper' brand of paint is almost 70 per cent more expensive than the whole lifetime cost of galvanizing, a much different perception from the outlay.

Galvanizing also has the ability to protect steel in various types of environments – both in exterior or interior spaces – including immersion in cold and hot water, corrosive sea water, and contact with other metals. This means that steel can be used in even the harshest conditions, including internal and external parts of the most complex architectural projects.

An estimated 4 per cent of the world's GDP is lost every year to corrosion, and with architecture being one of the top industries committed to enhancing and improving its sustainability efforts, it's no surprise that galvanizing is becoming the finish and protection of choice for the industry.



Manchester Galvanizing processed more than 1200 tonnes of steel on behalf of Total Steelwork & Fabrications Ltd as part of a biomass storage and transfer facility

A fresh approach to facade aesthetics

The sustainability and design life of zinc, copper and stainless steel facade and roofing systems have been major drivers affecting their growth. Improved cost effectiveness has also encouraged greater awareness of their technical performance and the scope they provide to create buildings of lasting visual impact. By Andy Denham, business development manager, ALM HM

'Finishes replicate some of the most popular colours in architecture today'

Though aluminium continues to be seen as the work horse of facade, rainscreen and roofing design, projects commissioned over the past decade provide ample illustration of the fact that placing aesthetics higher on the design agenda need not be cost-prohibitive. This in turn has given manufacturers the confidence to develop more colours, textures and finishes. Sales of stainless steel, perceived widely as the most expensive metal, were badly affected by the recession but the introduction of ferritic grades has given far greater cost stability and competitiveness. Its reliance at thinner gauges enables facades of considerably lower weight to be built without compromising performance in any way. Even so, by comparison with zinc which can now be seen throughout the UK on projects of immense diversity, sales are still modest. The introduction of contemporary copper alloys has also encouraged a wider spectrum of systems to be considered when previously they would have been discounted. Indeed the colours developed are in many cases now considered to be evocative of the metal concerned.

The introduction of contemporary zinc facade systems has seen the metal specified as interlocking and composite panels, shingles and flat lock tiles. A high proportion of projects continue to be specified in traditional standing seam, but pre-weathered and new colours have boosted use of what is a method proven for both facades and roofs. Bespoke options, such as perforated panels and the introduction of the first engraved zinc in major projects, such as the Stonehenge Visitor Centre have given a further boost to the metal's resurgence, taking its use in construction to new heights.

Non-ventilated, cold and warm roof construction has become increasingly popular with copper and stainless steel proving ideal for the purpose as they have no susceptibility to underside corrosion. In cold roofs zinc has traditionally required a continuous air space of at least 50mm between the substrate and insulation, but development of a protective underside coating has seen it used widely for compact roof specifications. For warm roof build-ups, the added benefit of fully bonded cellular glass insulation provides the added value, not just of the air gap, but an 18-20mm thickness of plywood.

All of which brings us back to aluminium. Despite the heavy extent to which it is and will doubtless continue to be used, product development has enjoyed a lower profile. Whether this

Leman St office project in East London shows varied colours of zinc interlocking panels

is because of its predominant market share, or because of strong association with projects in which cost is the main driver, is uncertain. The latter is to some extent unfair, but despite what is clearly a wide range of colours, many perceive them as lacking subtlety and would not consider them for their aesthetic value.

The introduction of Alu FX, development of which has been driven by the need for aluminium which can be specified for visual impact, offers what is described as a 'high end aesthetic on a low budget'. Used in conjunction with a vapour barrier such as Warmfast VB, a life expectancy of up to 60 years is routinely achievable and in addition to black, grey and bronze finishes, oxidised effects have also been created. These rely on use of textured coatings layered in such a way that the smooth surface has a depth which reflects different levels of colour tone. Intended to provide a low-reflective yet lustrous colour which looks like aged or rusting steel, they bring all of the cost and weight benefits for which aluminium is renowned (less than 2kg per m^2) with freedom from any problems with run-off. Finishes replicate some of the most popular colours in architecture today, the brushed and textured effects also giving a highly distinctive finish which it is felt will prompt immediate association with aluminium. Coatings are lead, chrome and isophorone-free and offer a Class A1 Fire Classification to EN13501-1. As with other metals, Alu-FX can be installed as a standing seam on vented plywood, in a warm roof on rigid board using fixings and vapour barrier to prevent thermal bridging. It can also be used with cellular glass insulation in buildings with extreme vapour drive, at pitches as low as 3°, for cladding, shingle tiles and flat lock systems.

BSkyB believe in better building

Sky's new Believe in Better Building, is an office and training facility with a clear social idea based around community focus, designed to enhance the wellbeing of the users. The super-flexible offices can be converted to interactive classroom environments for training and creative-thinking, or cleared to create sizeable corporate event spaces. The interiors are fresh, natural and fun, packed with state-of-the art IT, expressing a dynamic and social culture, where break-out and social space is as important as desks.

The aim of the project was to provide an inspiring exemplar of construction delivery and sustainability. Arup Associates' Unified Design approach has delivered the UK's first multi-storey timber commercial office, in a project programme of one year from inception to practical completion. The sequestration of carbon in the frame creates a building that goes beyond zero embodied carbon. The low-energy servicing strategy is integrated seamlessly into the building design, allowing the timber frame to be displayed in all its glory. It is the first building in the UK to be designed in accordance with the emerging Wellness Certification principles. The key principles of which are quality day-lighting, air quality, natural material selection, and great design. The team also specified materials that have low or no VOC content to avoid off-gassing problems. The extensive use of natural wood, internal and external greening provides human delight, celebration of SKY culture, and for human-nature interactions within the building.

The building is wrapped in large format rectangles made of ALUCOBOND® aluminium composite tray panels. The facade, featuring a combination of ALUCOBOND® in sunrise silver metallic and Anodized Look CO/EV1, offers an attractive contrast to the building's interior design in wood. ALUCOBOND® is fully recyclable and demonstrates a high level of sustainability: The core material and the aluminum skins can be returned to the material cycle and reused for the production of new material. The high intrinsic value of aluminum is a major economic incentive for its recycling. In fact, aluminum scrap can be repeatedly recycled without lessening its value or diminishing its properties. In addition, the energy used in recycling is a mere fraction of primary production requirements, often as little as 5 per cent, yielding obvious ecological benefits.

Flexibility is one of the keys to the project's success. It is designed to be intuitive, with a simple understanding of way finding and building function as well as providing a wealth of extremely flexible spaces to respond to the

varied and changing needs of the Sky users. A large, open-plan, column free space on the second floor for has been provided to accommodate large meetings and gatherings. The room partitions are therefore designed to achieve enhanced acoustic separation commensurate with the potential multi-media teaching in adjacent rooms in mind. A sweeping, open staircase starts at ground and rises through the triple height atrium. At first and second floors the stair width is increased to incorporate breakout spaces, and provides not only circulation, and visual communication across the floors and out to the plaza, but creates the social and interactive focus of building.

Paul Herbert, Specification Manager **07584 680263**
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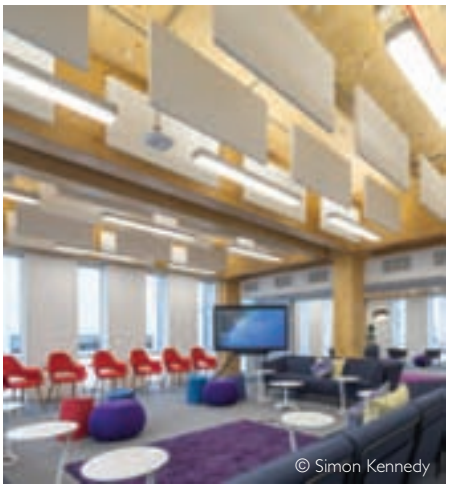

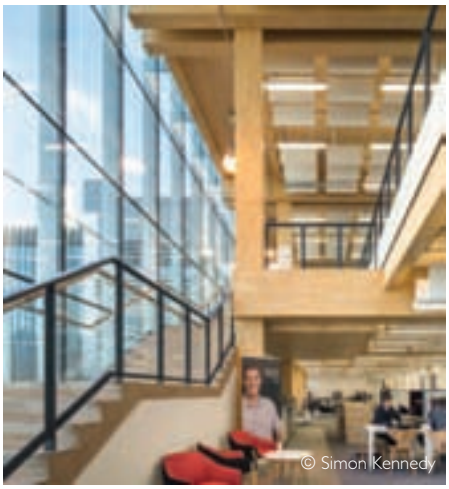

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enviro LEAD

UK's most efficient form of lead recycling becomes specifiable

Lead's heritage as a product at the heart of UK construction is beyond doubt and its place as a roofing, flashing, rainscreen and heritage material is secure.

Perhaps surprisingly, around twice as much material is used in contemporary architecture and house building as conservation and restoration. For all types of project, however, long design life, sustainability and the metal's malleability have combined in its favour, enabling it to be used for the most intricate detailing and decorative ornaments.

Lead enjoys an enviable record in terms of recycling and embodied energy to the extent that it has a BRE Green Guide A+ rating. Even so, in terms of the route to market for rolled lead sheet the existence of a British Standard, BS EN 12588, means that supply and procurement has traditionally been commodity driven. However, while the Standard provides a defined measure of quality, it doesn't differentiate between the source of raw materials or proportion of recycled material used.

Scrap lead recovered from building projects is straightforward to recycle, but the process is more complex in other industries. This is particularly so with car batteries for which, though disposal facilities are becoming more widespread, the economics of lead's extraction are far less favourable. To put some perspective on the problem, lead accounts for less than 58 per cent of a battery but around 80 per cent of lead produced worldwide is used in their production. Building projects account for just 6 per cent . Traditionally, therefore, the tonnage of unrecoverable material sent to landfill has been and seemed set to continue to pose a huge problem for local authorities.

Thankfully, this need no longer be the case due to an initiative by Envirowales, a 2IM Group company which not only reuses lead from batteries but recovers around 96 per cent of their constituent parts. These include its casing and electrolyte fluid (mainly sulphuric acid), the 'splitting' process extracting metal solids, sulphurised paste and polypropylene leaving only polyethylene which accounts for around 4 per cent . This too is the focus of a research programme to find a viable means of re-processing. For the rest, desulphurisation enables sodium sulphate salt to be extracted for use as a bulking agent in detergents, glass manufacture and even animal feed under a Feed Materials Assurance Scheme (FEMAS).

With the high demand for products in construction which demonstrate high sustainability 2IM and Envirowales have taken the unprecedented step of marketing the 'Envirolead' brand as a specifiable product. It carries all of the benefits of standard rolled lead and is manufactured no differently but, critically, it has an unprecedented chain of custody and no reliance on ore extraction. This gives architetcts an opportunity for the first time to capitalise on the one of the most efficient forms of recycling while guaranteeing that the product chosen has the lowest possible environmental impact. The scale of extraction is large with batches of 300 batteries (around 4 tonnes) being used in a process which eliminates any risk of ground or air contamination.

Reclaimed material is smelted and refined along with mill waste and scrap and then cast into slabs for the production of rolled lead sheet. As well as providing lead for use in batteries and

construction, the resulting material is supplied to Royston Specialist Cast for production of sash weights, lead bricks, radiation shields (for nuclear and medical environments), ballast and ammunition. Enviro Lead is supplied to a majority of these industries in addition to a nationwide network of builders' and roofing merchants through 2IM Group distribution centres, Associated Lead Mills Ltd and Jamestown Metals Ltd.

Recycling of lead enables the metal to be produced using only around one third of the energy needed to produce from ore. Around 20 per cent of existing demand is still supplied as new lead but car production worldwide is forecast to continue its upward trend so current energy saving projections are likely to be exceeded.

Specification clauses for Envirolead are already available through NBS Plus and a CPD presentation has been produced to highlight the benefits of specifying lead manufactured exclusively from such a tightly controlled resource. With an almost limitless supply of batteries for re-use, the supply chain for lead's use in construction is set for a major and what seems likely to be a permanent shift for the benefit of the environment.

07000 256467 www.associatedlead.co.uk

Excellence in aluminium from Metal Technology


The RIBA award-winning Students Union building at Manchester Metropolitan University, featuring Metal Technology high rise curtain walling and thermally enhanced doors

The intrinsic qualities of aluminium, its infinite recyclability, strength and lightness, durability and low maintenance qualities mean it is one of the most sustainable building materials available, according to Calvin Wilson, Managing Director of Antrim-based Metal Technology.

Established thirty years ago, Metal Technology is now one of the UK's largest independent aluminium systems companies. The company designs and supplies bespoke architectural aluminium window, door, curtain walling and solar shading systems for construction projects throughout the UK and Ireland.

Distributing its product range through a network of fabricator and installer partners with annual installation values exceeding £120 million, Metal Technology offers a comprehensive design and specification service to architects, developers and main contractors through a team of architectural advisors. Tailored specifications can be provided online with NBS standards, supported with CAD details and performance data as well as BIM family models for integration into construction drawings.

Metal Technology's systems have applications across the spectrum of modern building design, incorporating public and private sector schemes in housing, healthcare, education, leisure, retail and commercial applications. The versatility of the product range lends it to bespoke applications, resulting in some imaginative projects, such as the RIBA award-winning Students' Union building at Manchester Metropolitan University, which features Metal Technology's System 17 high rise curtain walling and System 5-20D Hi+ high performance thermally enhanced doors.

All products in the Metal Technology range not only offer engineered durability in use but high levels of structural integrity, weather and thermal performance to provide a cost-effective solution with no compromise on either aesthetic or performance.

028 9448 7777 www.metaltechnology.com

Bradite makes its mark

Bradite's CR27 Line Marking Paint has been used to restore a badly damaged motif on the tarmac outside a local church in Northern Ireland. Measuring approximately three metres in diameter, the motif required four 5-litre tins of CR27 supplied in three contrasting yet complementary RAL colours. CR27, from Bradite's extensive portfolio of high quality paints and decorative coatings, is a fast drying, universal road marking and line paint, suitable for application on asphalt, bitumen, concrete and brick, and on roads, runways, car parks and sports facilities. To achieve optimum results, the company recommends that surfaces be dry, dust free and clean of any contamination prior to application.

01248 600315 www.bradite.co.uk

Help is available from Durham Foundry

Durham Foundry is a Sheffield based iron foundry with over a hundred years' experience of helping customers find ways to use grey and ductile iron castings in architectural projects. Its customer base includes private and corporate clients and the company has been involved with both restoration and new build contracts. One of the services Durham Foundry offers is its wealth of knowledge of the metals it casts and the company can help designers and architects through the process of finding the right material for a job. If you want help with a material specification or just simply want to talk an idea through, give Durham Foundry a call.

0114 249 4977 castings@durhamfoundry.com

Double boost for CMS

A leading window, door and curtain walling manufacturer and installer, **CMS Window Systems** has boosted its aluminium division by adding one of the world's leading systems to its portfolio and obtaining CWCT membership. The company, which employs more than 200 people at its HQ and main manufacturing facility near Glasgow, has joined forces with Kawneer to become an authorised partner in a move which gives customers access to an even greater range of fenestration and building envelope solutions. Director of the Aluminium Division at CMS, Stephen Anderson, says the decision to join the Kawneer authorised dealer network was born out of the company's ethos of continual improvement. Strengthening its technical credentials further, CMS has also become a member of the renowned Centre for Window Cladding Technology (CWCT). This reinforces the company's commitment to delivering the highest technical standards within the building envelope market and its dedication to continuous improvement.

01324 841 398 www.cmswindows.com

Creative visual beauty from Emsea

Creative designers, Grace and Webb, looked to Emsea Ltd's extensive engineering knowledge to realise an inspirational art concept into a range of viable design features in a top London hotel.

Named as one of the Big Six Art Hotels worldwide, South Place Hotel, showcases an impressive five storey high polished aluminium sculpture, three floor to ceiling screens and a 21 metre long floating ceiling.

Developing the blueprints alongside interior designers, Conran and Partners, Grace and Webb drew inspiration from botanical foliage and branches.

"The vast exterior wall feature in the hotel's courtyard spans five floors and was created with maximum impact in mind," commented Natasha Webb, managing director of Grace and Webb.

She said: "I opted for polished aluminium to replicate the materials used in the original construction of the building, whilst still reflecting light and opening up the secluded space. This project was complicated but as always Emsea were great to work with, nothing was too much trouble and they came up with practical solutions to the technical issues."

The 30 large (15m x 4.5m) panels were spaced off the wall using a bespoke clip system engineered by Emsea, to create patterned shadows behind and allow for back lighting at night.

"We were provided with the artistic illustrations but the technical conundrums were ours to solve," commented Mark Causer, director at Emsea Ltd.

One such challenge included within the brief was that of a 21m long ceiling feature in Angler restaurant, suspended above dining tables and lit from within to give soft patterned reflections.

Mark said: "We didn't want Grace and Webb to have to compromise on the look and beauty of the designs. Natasha could focus on her job of creating artistically pleasing structures, safe in the knowledge that Emsea would figure out and deliver the rest."

01684 299156 www.emsea-laser.com

Kawneer helps score a unique try for Wales

Architectural aluminium systems by **Kawneer** feature on what is believed to be Wales' first twin-skin facade. The new postgraduate centre of Cardiff Business School at Cardiff University uses Kawneer's AA®100 SSG (Structurally Silicone Glazed) curtain walling as the external wall on the south-east facade with AA®100 zone-drained capped curtain walling with BRE Green Guide A+ rated AA®541 top-hung casement window vents behind, forming an internal walkway. This architectural phenomenon is complemented by AA®100 curtain walling on the main facade as well as the entrance atrium between two curved terracotta-clad elevations.

01928 502500 www.kawneer.co.uk

Aluminium – the trusted building material

Aluminium gives the architect the opportunity to design feature and style to a building every time it is specified. Naturally, each project is different and aluminium can complete the design concept of even the most innovative practice. Developments in 3D modelling and extrusion now mean that aluminium is the building material which literally pushes the envelope to the forefront of design. In essence aluminium is the building material that, through its long use, has developed to provide function, form and solutions for even the most demanding projects. Systems Houses, such as **Comar Architectural Aluminium Systems**, continually develop and refine their profile catalogues to meet the demands of cutting edge designers.

Levolux helps Suffolk go green

A bold new 'Energy from Waste' facility in Great Blakenham, Suffolk is having a surprisingly positive impact on the Suffolk landscape, thanks to an Aerofoil Fin screening solution from **Levolux**. The custom solution comprises aerofoil-shaped louvres each measuring 500mm wide by 50mm thick, applied across each of the building's four elevations. The extruded aluminium Louvres are set at a pitch of 750mm, assembled into panels using aluminium side-plates. All aluminium components, including the aerofoil-shaped louvres, are finished in an attractive and durable light blue powder coating. In contrast, all internal Roller Blinds are fitted with a white and charcoal fabric, with a 3 per cent openness factor.

Galvanised steel gutters – improved colour

Galvanised Steel is a great product for gutters and downpipes with its long-lasting, stylish looks. And **Rainclear Systems'** Steel system now comes with a new 'robust' colour coating in a choice of Black, Anthracite Grey, Dusty Grey, Grey White and Sepia Brown with next day delivery. ROBUST is an innovative coating system that is extremely hard wearing, comprising three layers of protection: Zinc, Primer bonding coat, and UV & scratch resistant 'Robust' polyester top coat. With a 15 year product warranty and a life expectancy of at least 25 years, if you are looking for a stylish, premium quality rainwater solution at a price tag that is closer to premium uPVC than heritage Cast iron or aluminium, look no further.

Five real reasons to choose steel

Lindab often get questions about comparisons of different materials. Frequently the choice is between steel versus plastic or aluminium. The choice at Lindab is, and has always been, steel.

Most of these arguments go for all steel systems, but Lindab think that even more can be added to this fantastic material. Lindab has been processing steel for more than 50 years.

1. Steel has the lowest carbon footprint of all rainwater systems materials

With steel you get a cost effective and environmental friendly installation that is 100 per cent recyclable. Lindab's Rainline system is made from sheet steel, a raw material that has a natural place in today's approach towards sustainability.

2. Steel stays in shape

Virtually all materials are affected by differences in temperature and grow and shrink as the weather changes. Compared to aluminium and plastic, steel

has a lot smaller movement factor. This means that your installation is much more likely to last as connections and fixation points won't take such a beating as with other materials.

3. It's really long lived

A rainwater system made of steel can last in excess of 70 years. To aid to the lifespan Lindab rustproof sthe material with a 275 grams zinc coating. This gives the system a self-healing quality where scratches and cuts are automatically sealed by zinc ions that migrate to re-coat the uncovered steel.

4. Strong as steel

Steel is the foundation of all modern construction, and there is a reason for that. Steel is strong. Snow, hail, falling tree branches and other circumstances can easily break a rainwater system made from alumnis or plastic materials. And even though Lindab recommend that you are careful during the installation, a steel system is much more heavy duty than its competitors.

5. Steel is actually cheaper than plastic or aluminium

The initial cost for a steel rainwater system is higher. We're not saying that it's not. But if you take into consideration the lifespan and maintenance needed for the respective systems, you actually save money. The life cycle cost for a steel system is considerably lower than any other system out there.

0121 585 2780 www.lindab.co.uk

Handmade bronze windows

Architectural Bronze Casements make bespoke, handmade bronze windows, doors and screens. Bronze is an exciting and traditional alternative to the steel and aluminium windows generally available. Made from architectural bronze which is strong, long lasting and visually appealing.

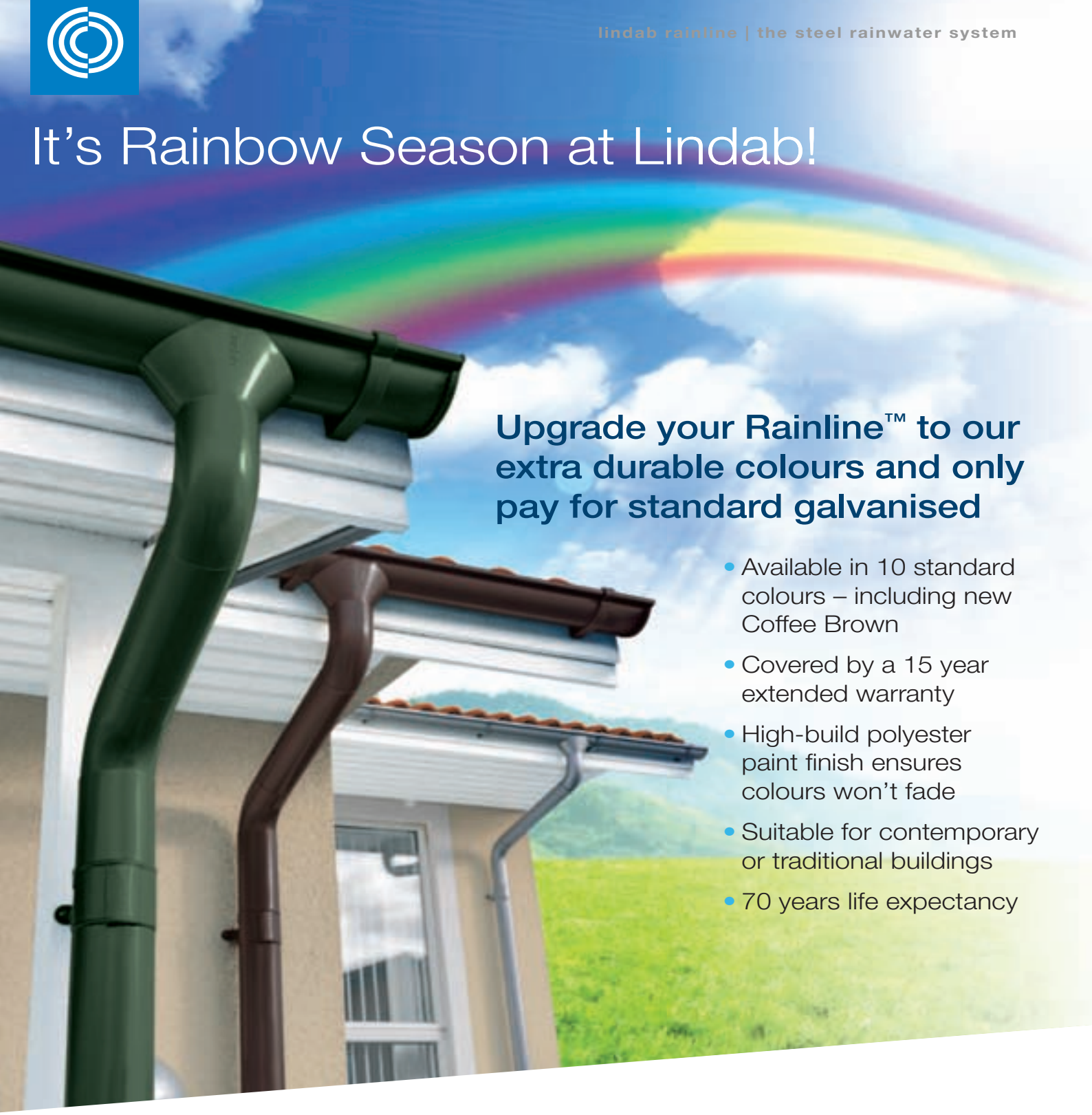
The company's systems offer fine sightlines, thermal efficiency and low maintenance characteristics. They are usually incorporated within stone, brick or timber openings. For more information email enquiries@bronzecasements.com or visit the website.

0845 6000 660 www.bronzecasements.com

T-Pren at the Royal Opera House

T-Pren from **Matthew Hebden** was used by the architects Dixon Jones to overcome expansion problems in the long metal gutters on the complicated roofs of the Royal Opera House. T-Pren forms a waterproof expansion joint, which eliminates the standard step detail and results in fewer rainwater outlets, which can be difficult to position inside buildings. T-Pren is a composite material with a centre section of neoprene to provide the expansion and contraction bonded to metal on either side, which is then soldered or welded onto sections of the metal gutter. The bonding is done under strictly controlled factory conditions in accordance with ISO 9002 quality standards.

It's Rainbow Season at Lindab!



Upgrade your Rainline™ to our extra durable colours and only pay for standard galvanised

- Available in 10 standard colours – including new Coffee Brown
- Covered by a 15 year extended warranty
- High-build polyester paint finish ensures colours won't fade
- Suitable for contemporary or traditional buildings
- 70 years life expectancy

For more information:

T: 0121 585 2780 E: rainline@lindab.co.uk

www.lindab.co.uk/rainline

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NB: • Not applicable to Black, Aluzinc, Natural Copper or Stainless Steel finishes • Please check availability, extended lead times may apply • Promotion available on orders received by Lindab 1st September 2015 to 23rd December 2015 • Terms and Conditions apply