Building envelope

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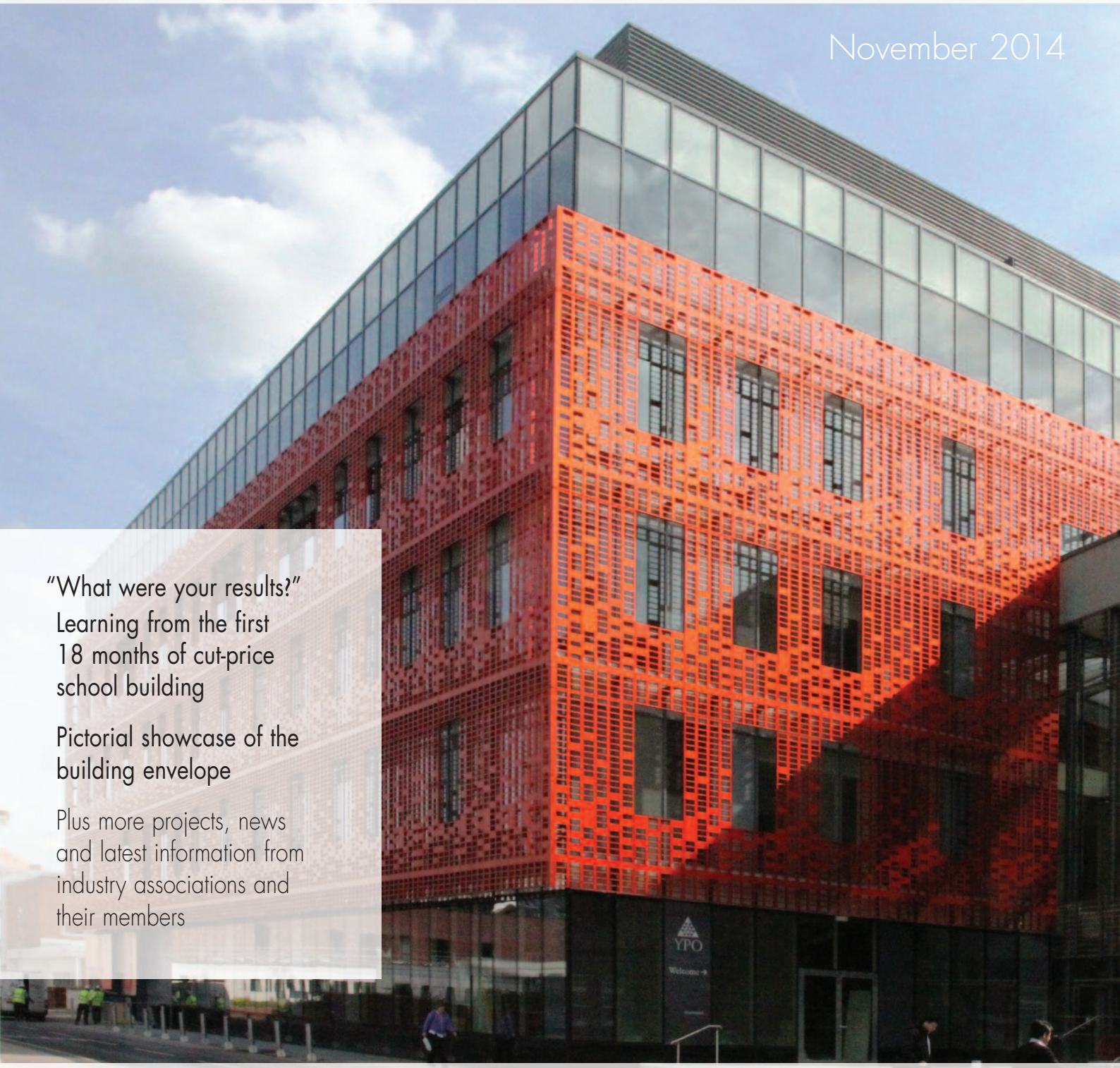
architects datafile

November 2014



"What were your results?" Learning from the first 18 months of cut-price school building

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Building envelope supplement

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november 2014

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projects

features

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Annual subscription to Architects' Datafile and supplements costs just £48 for 12 issues, including post and packing. Phone 01435 863500 for details. Individual copies of the publication are available at £5 each inc p & p.

Printed in England

Editor's letter

As architects are tasked with designing low-carbon, well-insulated and energy efficient buildings of excellence, I am delighted to bring you this special supplement dedicated to the all-important building envelope.

A weather, air and thermal barrier, it must be carefully planned to ensure that these functions are not compromised despite climate, ventilation and structural considerations, as well as the varying needs of different applications.

We therefore examine some of the new technologies and issues surrounding designing for the building envelope and include features from experts who specialise in this sector.

Among the topics we explore are: specifying solar control without jeopardising the thermal performance of the building facade; why architects should consider stainless steel as a building envelope material; insulated concrete form, building board specification, and off-site construction using unitised facades; while the results of an ecological comparison of facade renovation systems are revealed.

Ray Horwood CBE, chief executive of the National Federation of Roofing Contractors also discusses revisions to BS 5534 and the GRO code and their implications, while Andrew Carpenter, chief executive of the Structural Timber Association, outlines how timber can achieve a high performance building envelope.

As the building envelope is a large cost factor in educational buildings, we bring you a special report by Michael Willoughby as the impact of the new funding programme takes effect. The Priority School Building Programme (PSBP) has replaced the Building Schools for the Future (BSF) Programme meaning that prioritised schools in need of repair or re-build must be built smaller and cheaper. But how are architects delivering schools without comprising the performance of the envelope? Read more on page 10.

And finally, as we head towards the end of 2014 on behalf of the netMAGmedia team, I wish you a very Happy Christmas and New Year.

Sarah Johnson

Latest plans released for Battersea Roof Gardens and Prospect Park

Battersea Power Station Development Company (BPSDC), on behalf of the shareholders of Battersea Power Station, has proudly revealed the latest designs for Battersea Roof Gardens and Prospect Park before the global launch for Phase 3 of the development

The crowning jewel of the Foster + Partners Battersea Roof Gardens is the landscaped garden that sits on top of 15 residential storeys and stretches over 355m long, which is being designed by James Corner Field Operations who created the famous High Line in New York City. This will be one of the largest roof gardens in London. The stunning space will be illuminated at night and will change subtly through the seasons. While Field Operations have taken inspiration from America – this garden will be very different and more like a grand city garden, with more intimacy and moments to sit quietly as opposed to the public thoroughfare of New York's High Line that sits on the raised disused railway lines. There will be opportunities throughout the year for the general public to enjoy this unique space, alongside the residents.

At the end of the rooftop is the fitness deck that supports any number of resident uses and activities, from exercising and fitness classes to children's play, gatherings and parties and small movie screenings. At the extreme tip of the rooftop is the lookout; residents can step through a narrow opening between large canopy trees into an intimate overlook that offers spectacular views of the power station and city.

The Woodland Walk will be the most beautiful and powerfully dramatic space on the rooftop; a dense forest of birch trees 'in the sky'. The white trunks of the birch trees will be a theatrical foreground to the Power Station chimneys beyond. The garden walkways meander around the birch planters, creating a sense of journeying through the woodland, while also choreographing new views, vistas and orientations. Timber seating rings and free standing hammocks offer places to sit, relax and lay out.

At the centre of the rooftop is the Sun Lawn. Oriented directly perpendicular to the power station chimneys, it provides a wide open horizon to take in the view, the weather and the scene, while also allowing for activities. Picnicking, sunbathing, star gazing and evening movies may be especially popular day-to-day activities.

The Sun Lounge and Summer Kitchen will be the most active and social features for residents on the rooftop. Set within a flowering perennial garden, the Summer Kitchen offers residents a large, communal "farm table", prep work station and a raised picnic lawn. Each of these features is an amenity for individuals using the farm table as a work surface to cater for small gatherings, lunches, barbecues and dinner parties.

North of the Summer Kitchen is the Sun Lounge; a collection of custom v-shaped chaises, that are alternately oriented to the south and to the sunset, or to the chimneys and the Gehry Partners 'Flower' building. The lounge will be a spectacular attraction for visitors to London: stepping out onto the rooftop, with the chimneys looming large in full-view. The lounge consists of several amenities for the hotel guests: cabanas, a bar, seating and dining areas, several theatrical 'lookout' spaces, all set within a garden setting of perennials, grasses and tall canopy trees.

James Corner, principle of field operations describes the rooftop garden as: "An extraordinarily serene yet dynamic place to view the power station, the

Thames River, the City of London and the surrounding context. The design of pathways, plantings, overlooks, furniture and special settings offer an air of theatricality and drama in the sky, making the garden a very special and unique experience in the context of London."

Grant Brooker, senior executive partner of Foster + Partner says: "We have worked on many gardens but never before on this scale. To create a garden this spectacular in our home city, that is so near to the power station that we all love is very special. There is simply no roof garden like this in any private development in the world so it really does offer a unique residential opportunity."

As well as this stunning new roof garden Phase 3 development offers other new communal green areas for the residents and public to enjoy. To the east of Prospect Place, is a new 1.1 acre Prospect Park; designed by Gehry Partners. This exciting new area will create a natural connection from Vauxhall via a new planned linear park that will lead from Battersea Power Station up towards the US Embassy and beyond.

'The Woodland Walk will be the most beautiful and powerfully dramatic space on the rooftop; a dense forest of birch trees 'in the sky'

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SHORTLIST

Shortlist announced for the CIBSE Building Performance Awards 2015

The shortlist for the 14 categories of the CIBSE Building Performance Awards 2015 was revealed on 28 October.

A special reception to announce the shortlist was held at the end of the first day of Chartered Institution of Building Services Engineers' new flagship Conference and Exhibition: Leadership in Building Performance, at the QEII Conference Centre in London.

The Building Performance Awards judging panel said that they had been impressed with the reach and quality of entrants in all of this year's award categories. It was, for example, the first time three entries from Australasia had been shortlisted in the International Project of the Year category.

In the new Lighting for Building Performance award category, the judging panel particularly praised the "inventive" entrants, saying that they would set an example for other buildings to follow. With so many strong projects – displaying evidence that included post-occupancy evaluation and recyclability – the judges said that any of the shortlisted projects would be worthy of winning this category.

The awards are unique in the industry in that they don't just examine the design of projects and products. Hywel Davies, CIBSE technical director and chair of the judging panel, said: "What sets our awards apart is that they are focused very firmly on assessing how buildings perform. This is of particular importance when both energy security and generating capacity are increasingly uncertain."

Highlighting the significance of improving energy use in buildings, reception attendees also heard from guest speaker Philip Douglas, head of energy efficiency strategy & directive team, DECC. He discussed the importance of building performance and the government's new Energy Savings Opportunity Scheme (ESOS).

The winners in each award category, and the recipient of the overall Carbon Champion of the Year Award 2015, will be announced at the Building Performance Awards event to be held on 10 February 2015 in London.

'The Building Performance Awards judging panel said that they had been impressed with the reach and quality of entrants in all of this year's award categories'

Christchurch International Airport, nominated for International Project of the Year for Beca

'The new LABC Registered Construction Details will be relevant in England, Wales and Scotland, though there are differences in the calculations'

REGISTERED CONSTRUCTION DETAILS

Industry launch of Registered Construction Details for England and Wales

Local Authority Building Control (LABC) and the Modern Masonry Alliance (MMA) have agreed to work together to produce a wider solution to the masonry construction market with a suite of 250 registered masonry construction details designed to minimise heat loss through the weak junction points in a building's outer envelope.

The Department for Communities and Local Government (DCLG), Zero Carbon Hub, many industry trade organisations and manufacturers have been pushing for packaged construction details showing how the design, specification of materials and assembly of construction joints should be accomplished. Construction joints are those parts of a building where different elements meet and are joined together. These are the focus of attention because research has shown that these create thermal bridging, which allows heat to leak out and can also create cold spots internally.

A major reason for creating and publishing Registered Construction Details is that small and medium enterprises may lack the technical knowledge to interpret the building regulations and create a design and specification that will achieve or surpass the required performance standard. Similarly, contractors also want a solution-based construction template that will prevent accidental flaws causing energy to leak. When the building is completed, the owner will be assured of lower heat loss, fewer occurrences of condensation (and associated mould) and a healthier atmosphere.

LABC and the MMA agreed to work together to deliver this to customers free of charge. Users will include: architects, plan drawers, developers, housing associations, SAP assessors, local authority building control surveyors, quantity surveyors, clerks of works, contractors and builders.

The scheme has been launched by LABC Chief Executive Paul Everall at the MMA 2014 Housing Summit on 21 October at ARUP, Blythe Gate Blythe Valley Park, Solihull B90 8AE.

UNIVERSITY TRANSFORMATION

Clegg Construction secures multi million University contract

Clegg Construction has secured a £3.75 million contract as part of the University of Leeds' £5.4 million transformation of its School of Mathematics into a 21st century learning facility.

The contract involves a complete overhaul of the Grade II listed building's interior to provide a variety of new study environments while ensuring the facility, located in the heart of the university campus, remains fully operational. The new learning environment includes social areas, group study areas and a library and seminar room for individual work which can be converted into a large single space for events.

The building was designed by architects Chamberlain Powell & Bon, a company that became famous in the 1960s for pushing concrete technology to its limits. Its work at the University of Leeds and design of the Barbican in London, which is one of Britain's largest listed buildings, are now recognised as being among the best buildings of the 1960s.

The transformation of the School of Mathematics forms part of the university's five year £300 million improvement programme and is due for completion next summer.

"What were your results?"

Learning from the first 18 months of cut-price school building

Roving reporter, Michael Willoughby, talks to experts who provide hints and tips on maximising quality in the envelope

'The average cost of a new school was between £25-30 million, with some costing over £50 million'

It's been a year since the Education Funding Agency (EFA) Large Contractor Framework was launched, and 18 months since ground-breaking took place on the first school to be built using the Priority School Building Programme (PSBP).

The PSBP is the coalition's replacement for the last government's Building Schools for the Future (BSF) programme. The £55 billion programme to rebuild or renew all schools was a sitting duck target for the then new education secretary, Michael Gove. The average cost of a new school was between £25-30 million, with some costing over £50 million. The media also focused on controversial projects such as Foster's £31 million Bexley Business Academy, which was dogged with problems. Sure enough, Gove axed it in 2010.

Yet projected UK population growth and immigration is driving an average 12 per cent increase in schools places required across the UK (23 per cent in London) by 2024. Many buildings of the 1950s and 1960s are still in service, long after they should have been levelled. So the parsimonious government has had no choice but to continue a schools building programme. But there were rules.

Instead of overhauling every school in the land, the coalition prioritised the 261 schools most in need of repair. Costs were circumscribed at £1,113/sq m (versus apparently between £2,000 to £2,900/sq m under BSF). Baseline designs and areas based on pupil intake and number are specified in "baseline designs" and must be complete within six months. Schools were targeted to be 15 per cent smaller and 7 per cent cheaper.

The building envelope is likely to consume the largest cost of a school (19.3 per cent according to the US' National Institute of Building Sciences). So, for this supplement, Architect's Datafile sought out expert schools' architects and suppliers to ask them what they had learnt building with the highly challenging EFA budget so far.

Holly Porter, founding director, Surface-to-Air Architects

Classy facades with simple prefabricated layouts

"We have been creating schools for 10 years, starting under BSF, the buildings were going bonkers. The envelopes were crazy. No expense was spared. Architects were having a great time! But clients weren't necessarily getting value for money – it wasn't being spent in the way it should have been. You had problems like the green wall at Paradise Park Children's Centre in Islington, which could not be maintained and, so, died.

Our method remains to make use of techniques perfected in the office sector – to employ simple layouts with a high-quality finish.

Since the funding was cut, this has been a massive challenge. We have found that the only way to achieve the price point is to use a combination of standardised or prefabricated elements along with buying in bulk.

If you want quality at a low price you are not going to be using on-site building because you are relying on subcontractors. At least with factory finishes you have a chance of getting a high-quality spec.

The main players in prefabrication suitable for schools include Laing O' Rourke, and its concrete system, cross-laminated timber (CLT) providers, such as B&K Structures, and whole-school solutions like Willmott Dixon's Sunesis.

We work most often with Yorkon for the system and then employ high-quality finishes. Modular prefab can be highly adaptable if used properly.

Finishes don't have to be boring, but they must be practical. We are particularly keen on Parklex, a timber-veneer cladding used on George Spicer Primary School in Enfield to create a grained effect. We employed colourful and syncopated Trespa rainscreen cladding for City Farm School, Barking and Dagenham and All Saints, Croydon.

We also use floor-to-ceiling glazing and bricks – although even the latter are becoming expensive.

At the moment, we are investigating Rodeca's colourful translucent material used on the Laban. But today's school clients can't afford to be into innovation in materials – they will only approve something which has been used 10 times before, having learnt from the mistakes of the past.

All in all, I think schools – with the development of prefabrication techniques which have been used in Scandinavia for many years – are a very exciting sector to be in. It's where progress is being made..."

Lee Fordham, Associate Architype Architects

Learning from Passivhaus for airtight envelopes

"Under BSF we built several schools better than Passivhaus (PH) standards, with air tightness levels below 0.3 air changes per hour at 50 Pascals pressure – the PH requirement being 0.6. We started at prices over £2,000 a sq m and managed to reduce costs to £1,800 then £1,700, and we were making further progress. But there is no way we could have got down to £1,100!

Nonetheless, we have managed to learn lessons from our work in order to maintain air tightness at around 3 with a target of 5, while keeping within the EFA funding requirements. That's better than half Building Regulations' requirements of 10.

We maintain just one airtightness line through the building – in other words, the insulation is continuous. It makes it

Continued overleaf...

'The building envelope is likely to consume the largest cost of a school (19.3 per cent according to the US' National Institute of Building Sciences)'

Cambourne College, Yorkon

'EFA schools are certainly basic, and if you are – like us – trying to push the boundaries of PH, you will find experimenting in other sectors is the way to go'

Lee Fordham, Associate
Architype Architects

Saint Gobain system
in Slough

easier to test and harder to destroy later on by, for example, punching a power point through it.

Furthermore, the insulation should wrap the building with the structure inside it unbroken – even if things don't line up properly. For example, if you are designing a detail at parapet level you try to join the lines of insulation together externally. It's not the usual, we know, but it helps to avoid thermal and cold bridging. Our approach is to use the minimal budget for robust details.

We would usually use prefabricated timber frame on our schools, insulated after installation. However, under the EFA we work on frameworks and the contractor generally goes with steel frame and poured concrete. We have tried to push them on timber frame, because environmentally we think it's the best way to go, but they haven't gone with it. We can only assume it is a cost issue.

Another place we had worked out a cunning timber solution was reducing noise inside the schools by creating acoustic wall panels from off-the-shelf CNC and birch-based plywood. But with these costs, we have little choice but to use ceiling tiles to absorb sound.

For the MVHR we would have used before, the team goes with Breathing Buildings, a low-energy ventilation system that is proving popular among specifiers.

In summary, the EFA schools are certainly basic, and if you are – like us – trying to push the boundaries of PH, you will find experimenting in other sectors is the way to go!"

Mark Allen, head of technical for Saint Gobain

Choose technology for efficiency

"Software can be the key to not only building more efficient schools' envelopes, but creating a better quality of life for its inhabitants.

DIAL is a German company that has created a free technology that helps designers create suitable artificial versus natural lighting designs in buildings. Using the tool, a school envelope is entered tagged to a particular global location and orientation and the programme will give lux values and relative visual simulations throughout using coloured squares for comparison.

The benefit of this is that you are able to accurately model the best place to put windows to maintain the correct lux values. This helps with energy conservation while providing adequate internal comfort along with correct temperatures to propagate maximum productivity in a learning environment. Many contemporary buildings are poorly designed from a lighting point of view because we use simple 1970 metrics like day-lighting factors. This can result in as-built performance, having in glare on the south side and it being too dark on the north, simply because the metric is too simple.

Better design will lead to efficiencies and savings and correct lux values by choosing the right glazing characteristics and window frames, light fittings – and paint colours!

The other benefit is that by remaining in control of glare, you can reduce the need for blinds, which subsequently then require artificial lighting. This uses excessive energy, but also produces unwanted heat, so you can control the comfort requirements of a building and reduce potential for overheating and thereby remove the desire for mechanical cooling, together with related items which cost to run, maintain etc.

If we do need to design for overheating then we can use Rigidor boards on internal partitions or concrete, and, because we have optimised the solar gains versus internal lighting quality, many of the parameters that increase the overheating scenario are removed. We can therefore also optimise the requirement of heat sink materials to allow a flexibility building solution without the requirement for large thick concrete structures.

With regard to thermal mass of the envelope, there seems to be a misunderstanding that thicker walls absorb more heat. But in fact it is only the first 100mm of dense materials that forms the heat sink and so thin layers of product can combat overheating without the excessive use of air-conditioning.

These matters are not just about sustainability – but are about healthier schools that boost teachers' well-being and student results."

'Software can be the key to not only building more efficient schools' envelopes, but creating a better quality of life for its inhabitants'

Mark Allen, head of technical for Saint Gobain

Off-the-shelf school envelopes

In light of the changing funding environment, several companies have created schools which can be ordered like an off-the-shelf product with a guaranteed price tag.

Sunesis from Willmott Dixon and Scape (a public-private partnership) delivers a whole-school envelope and interior walls for a defined cost over a fixed timescale. There are 12 different designs to choose from, divided into primary and secondary, and arranged by intake for primary schools and number of pupils for secondary. As an example, £2.8 million will buy you a two-form entry primary school including nursery school measuring 11,100 sq m built over 53-59 weeks, and 30 per cent cheaper than standard-build (although the schools are bricks and mortar).

However, Yorkon and Surface-to-Air are working on a modular product called the Configurator, which offers more flexibility based on the former (a Portakabin company's) designs. School specifiers can choose the exact dimensions of internal areas, as well as finishes while being sure that they fit the EFA price tag.

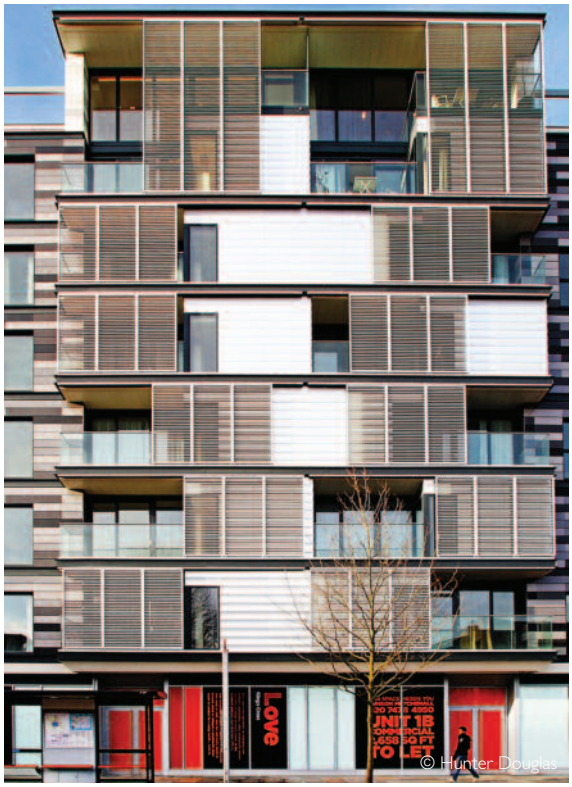
"We don't just make grey boxes anymore," says Portakabin director, Kevin Jones, of his company's schools. "They come in a multitude of sizes. We can specify air source heat pumps or mechanical cooling to fit the financial targets as well as a myriad of cladding options."

Building Envelope showcase

Specialist architectural metal fabricator Metalline have enhanced their manufacturing reputation with the installation of a range of their aluminium metalwork on The Point office redevelopment in Maidenhead

Knauf's Warm Wall Plus external wall insulation system (EWI) has made a major contribution to both the thermal performance and visual appeal of the most environmentally advanced building to date at the University of East Anglia (UEA) in Norwich. The building's external walls are a combination of energy-efficient glazing and Knauf's high-performance system with contrasting bright white and eye-catching pink render finishes. Some 32 percent of the external walls feature the Warm Wall Plus system, contributing to an overall 'U' value of just 0.1 W/m2K. The system was specified by Kier following successful use of the company's products on previous buildings at UEA.

South Devon College sets a shining example as CA Group Limited's SolarWall technology is installed at its South West Energy Centre. The move is estimated to deliver annual heating savings in excess of 15,000kWh and 3.0t CO2 – more than the amount consumed by the average domestic property in the UK.



The striking ArtHouse apartment complex in King's Cross features an innovative Hunter Douglas louvered, sliding shutter system. A total of 435 sliding shutters with manual and motorised systems were installed, along with soffits with linear ceilings and bespoke aluminium fin centres. The project also presented particular design and installation challenges, such as the double height shutters of over 6m for the ArtHouse's duplex apartments.

Solar shading meets thermal performance

When specifying solar control, not just any curtain walling bracket will do if the thermal performance of the building facade is not to be compromised, says solar shading and screening solutions provider Levolux

While glass continues to be the predominant cladding material for commercial buildings, its thermal performance is now being placed under closer scrutiny.

A glazed facade, formed from a modern curtain walling system, will still be susceptible to excessive solar heat gain when it is exposed to direct sunlight for long periods. This can have a significant impact on the cooling loads of a building. While a degree of solar gain is appreciated in winter, if left unchecked, it will make a building overly dependent on air conditioning during the summer.

As energy costs have soared over recent years, this has changed the focus of architects not only on meeting the required building regulations and satisfying a client's brief, but also on maximising the thermal performance of buildings.

Buildings are increasingly designed with greater emphasis on passive cooling techniques. This demands a more considered approach to curtain walling, as there is often very little flexibility for it to accommodate external solar control devices.

Shading performance for devices can vary enormously and this is defined by a Solar Heat Gain Coefficient (SHGC) rating. For instance, a double glazed opening without any form of solar control will have a SHGC rating of around 0.65. The same double glazed opening fitted with moveable horizontal fins will have a SHGC rating of around 0.1.

While it is important for an architect to consider the SHGC rating of a shading device, attention should also be given to how the device is secured to the curtain walling. Any savings that may be achieved by incorporating a shading device with a high SHGC rating can very easily be undermined if the bracket used does not incorporate an effective thermal break.

Perforated red screening, Citylabs (former Royal Eye Hospital), Manchester (above) and timber fins, University of Derby (left)

Typical curtain walling brackets may satisfy load-bearing requirements and may be compatible with a range of curtain walling systems, but perhaps the more important question is how they penetrate the curtain walling mullion. If the bracket does not incorporate a comprehensive thermal break, then it will be susceptible to cold bridging, acoustic and vibration transmission and interstitial condensation.

Under Part L of the building regulations, a new commercial building must have a U-value of less than 2.2 W/m^{2}K. One of the key considerations for engineers when targeting a low U-value, is the thermal transmittance rating, or 'χ', of materials used to form the building envelope. If a curtain walling bracket compromises the thermal break of the curtain walling, this will raise the U-value of the entire building envelope, possibly by as

Continued overleaf...

'Buildings are increasingly designed with greater emphasis on passive cooling techniques'

Horizontal fins (five groups of three fins), Velocity Building, Weybridge (right) and horizontal fins (two groups of six fins), University of Warwick, Mechanochemical Cell Biology Building (far right)

'Upon close inspection, it is relatively easy to assess the effectiveness of a 'thermal break' as a feature of a curtain walling bracket'

much as 10 per cent.

It is therefore critical to assess a number of curtain walling brackets from a variety of manufacturers and demand evidence of the thermal transmittance rating or 'χ' for each bracket.

As a guide, a curtain walling bracket with a good thermal break should deliver a thermal transmittance rating of around 0.14 W/K, while a bracket without a thermal break would achieve around 0.42 W/K. It is also advisable to ask if testing was carried out by an independent body, such as the Centre for Window and Cladding Technology (CWCT).

Upon close inspection, it is relatively easy to assess the effectiveness of a 'thermal break' as a feature of a curtain walling bracket.

A thermal break can be defined as "an element of low thermal conductivity placed in an assembly to reduce or prevent the flow of thermal energy between conductive materials".

In the case of curtain walling, the most conductive element is the grid of aluminium mullions and transoms that are used to secure glazing. The more isolated a conductive material is, such as aluminium, the more effective the thermal break and the lower the U-value achieved by the curtain walling.

Many curtain walling brackets purport to feature a thermal break, but when examined in detail, it is clear that while an insulating material is present in some areas, this is not comprehensive enough to prevent the curtain walling mullion from being compromised and cold bridging from occurring. This increases the risk of interstitial condensation developing inside the curtain walling structure. Over time, this can weaken the curtain walling structure and lead to mould growth forming.

The optimal design for a curtain walling bracket is for it to fully isolate the mullion at the point of penetration. A low conductivity, insulating element should be used throughout the bracket, perhaps in the form of insulated bolt sleeves and screw caps to ensure the thermal break is comprehensive. When this is achieved, the thermal performance of a curtain walling system can be maximised. A U-value of less than 0.9 W/m^{2}K is then a real possibility, which is around 50 per cent lower than an average commercial building facade.

As an additional benefit, the inclusion of an insulating element can help to prevent noise and vibrations being transmitted into a building.

When it comes to specifying solar control for a building, it is therefore not sufficient to accept any curtain walling bracket, but demand one that is fully isolated, with a comprehensive thermal break. This will ensure that the thermal performance of a building's facade is not compromised.

Ecological comparison of facade systems

The results of an ecological comparison of facade renovation systems are revealed by Ian Anderson, managing director at rainscreen cladding manufacturer Steni UK

The growing popularity in the UK of dry-trade construction methods has led to a plethora of rainscreen cladding systems, ranging from thin-film aluminium or steel cassettes to fibre cement and glass fibre reinforced polyester composite panels.

Along with the actual panels themselves, the fixing systems also differ, with specifiers and designers able to choose between wood, aluminium or steel stud in different thicknesses as well as glue. So where on earth do they start when choosing which cladding system to use?

Given their capability not only of transforming a building's visual appeal but also its performance, particularly in terms of thermal insulation, rainscreen cladding systems have become something of a modern-day wonder product although they in fact date back decades.

Not only are they capable of breathing new life into ugly, tired and poorly-performing commercial, education, healthcare, leisure and residential buildings, including high-rise tower blocks, they are also a highly efficient way of branding buildings, with a wide range of colours and finishes enabling them to adopt corporate colours.

The principles of ventilated rainscreen cladding allow for thermal movement and moisture dispersion through panel joints and a ventilated cavity. Basically the cladding is fixed back to the main support structure with one of the aforementioned methods, to form a weather, impact and rot-resistant, colourful and relatively lightweight jacket.

The benefit of the rainscreen system is that any moisture, either ingress or humidity, is ventilated out of the cavity at the rear of the panels, ensuring the insulation and inner leaf of the building are not affected by interstitial condensation.

The environmental performance of different cladding systems and fixing methods in renovation projects was the subject of a study by the Tampere University of Technology (Department of Civil Engineering, Institute of Construction Economics and Management) in Finland. This focused on the impact of manufacture and use and maintenance.

The *Ecological Comparison of Facade Renovation* report helps specifiers better understand the environmental credentials of the various rainscreen systems and make better-informed design and specification decisions.

It concluded that glass fibre reinforced polyester composite rainscreen panels ecologically outperform competitors in numerous tests, ranging from Global Warming Potential (GWP) to Photochemical Ozone Creation Potential (POCP).

The study states: "The comparison shows that of those facade coating products examined, glass fibre reinforced polyester composite has the least impacts on environment, measured by the LCA factors."

The study was conducted using mainly Life Cycle Analysis developed by the Society of Toxicology and Chemistry (SETAC) – transportation and the effects of the energy required for renovation work were not taken into account.

The investigation considered seven different system materials – glass fibre reinforced polyester, fibre cement, brickwork, concrete panel, plastering, thin film steel cassette and thin film aluminium cassette. Insulations studied were glass wool and expanded polystyrene. Framing systems were aluminium, steel, wood studs and punctual fastenings.

The Global Warming Potential, Acidification Potential (AP), Nutrification Potential (NP), Photochemical Ozone Creation Potential (POCP) and Critical Air Volume (CAV) were compared and in each category glass fibre reinforced polyester panels recorded the lowest – and therefore most advantageous – readings. Indeed, in most cases, its results were less than half of its closest rival.

Take for example the GWP results. Glass fibre reinforced polyester rainscreen cladding panels 8mm thick returned a reading of 2,400g of CO_2 per sq m of wall surface. The next closest was 8mm-thick fibre cement boards at 5,800g CO_2/m^2. An 85mm brick facade was rated a massive 28,000g and a 130mm brick facade even greater at 39,000g CO_2/m^2.

As mentioned previously, these results were mirrored in all

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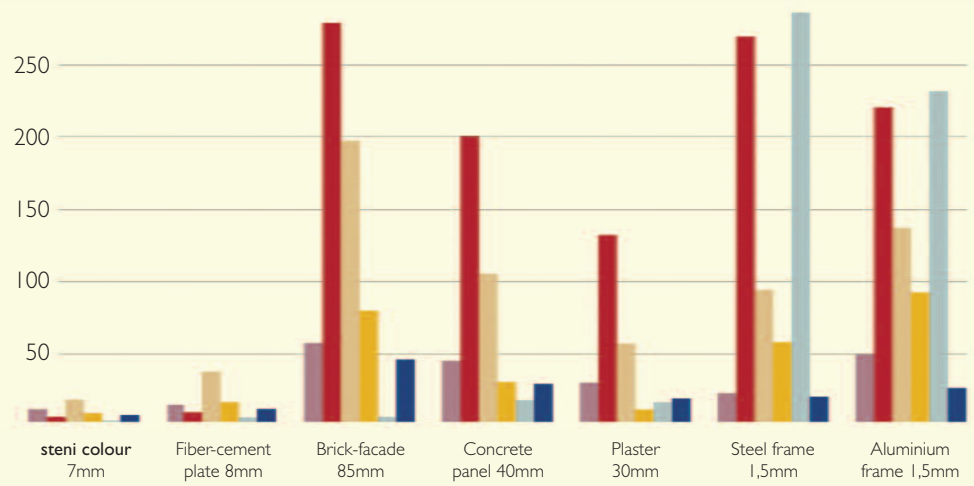
'The benefit of the rainscreen system is that any moisture, either ingress or humidity, is ventilated out of the cavity at the rear of the panels'

Ian Anderson, managing director at Steni UK



Ecological comparison of different facade materials

- **Energy Content** ((MJ) $10^{-1}/m^2$ wall surface)
- **Acidification Potential (AP)** ((g(SO_2)/m^2)/wall surface)
- **Photochem. Ozone Creation Pot.** (POCP) (((mg(C_2H_2)/m^2)2,5)10^{-1}/wall surface)
- **Global Warming Potential (GWP)** ((g(CO_2)/m^2)10^{-3}/wall surface)
- **Nutrification Potential (NP)** ((g(phosphates)/m^2)10^{-1}/wall surface)
- **Critical Air Volume (CAV)** (1000m^3 of substitutial air) 10^{-1}/wall surface)

Extract from Tampere University of Technology, Dept. of Civil Engineering, Institute of Construction Economics and Management; Ecological Comparison of Facade Renovation. The separate columns compare the actual ecological loading for each product group (low value reflects low environmental loading). The diagram does not rank the various environmental loads against each other, because of differing designations/weighting and environmental consequences.

Steni will be pleased to send you the complete report – available in Finnish and English

During the development of facades much emphasis has been placed on reducing evironmental impact, both in terms of the resources and energy used during manufacture and the end product's effect on the environment and natural cycles. Through several independent tests, it was able to document this as fact, as can be seen from the diagram above

but one of the categories studied. Take the POCP results – 8mm glass fibre reinforced polyester composite panels returned a score of 5mg CO_2/m^2 of wall surface. Its closest rival was again, 8mm fibre cement board with a score of 17mg CO_2/m^2. Thin film aluminium cassette (1.5mm thick) scored 5,800mg CO_2/m^2 and thin film steel cassette (1.5mm) 7,700mg CO_2/m^2.

Acidification Potential results also reinforced the sound environmental performance of glass fibre systems, which scored 15g CO_2/m^2 of wall surface. Fibre cement board (8mm thick) was the next closest with a rating of 35g CO_2/m^2. Other results included 1.5mm-thick thin film aluminium cassette – 136g CO_2/m^2; 85mm thick brick facade – 197g CO_2/m^2 and 130mm thick brick facade – 274g CO_2/m^2 of wall surface.

When Nutrification Potential was studied, glass fibre reinforced polyester systems were virtually matched in performance by 30mm of plastering [0.6g (phosphate)/m^2 of wall surface and 0.7g (phosphate)/m^2 of wall surface respectively]. Fibre cement board scored 1.3g (phosphate)/m^2 and 40mm concrete panel returned a reading of 2.5g (phosphate)/m^2. Brick facade (130mm thick) topped the NP scale with 10.5g (phosphate)/m^2, with thin film aluminium cassette of 1.5mm thickness scoring 9.1g (phosphate)/m^2.

Glass fibre reinforced polyester systems also performed well in tests measuring the energy contents of facade materials, registering the lowest score of 80MJ/m^2 of wall surface. The highest was 130mm-thick brick facade, with a reading of 750MJ/m^2.

The study also demonstrated that framing materials have an impact on environmental performance. In every category, wood stud was the most ecologically-sound fixing medium. For example in GWP tests, wood stud (30mm) scored 560g CO_2/m^2 of wall surface, compared with 30mm aluminium stud (8,800g CO_2/m^2) and 30mm steel stud (7,600g (CO_2/m^2).

Concluding the report, scientists looked at the ecological impacts of a modernised wall structure during a period of 25 years from renovation. As would be expected, the better-insulated the property, the less ecological impact it caused.

The report stated: "The most ecological alternative of those studied proved to be a ventilated structure supported with impregnated long length wood, insulated with 100mm thick glass wool and covered with glass fibre reinforced polyester composite."

ICF – the concrete choice for true building performance

Jean-Marc Bouvier, UK technical manager for Insulated Concrete Form (ICF) manufacturer NUDURA, talks about how this proven building envelope technology offers a fast-track, economical and sustainable solution that's built to last

Building with Insulated Concrete Forms (ICF) is a proven way of creating an eco-friendly, stronger, safer building that's highly energy efficient, needs minimal maintenance and repair; and one where design possibilities are limitless. It's a modern method of construction suitable for commercial, residential, industrial, institutional, healthcare and a variety of other building types.

Switching from traditional building methods to ICF technology will significantly reduce labour and increase speed of build. ICF offers considerable benefits over both brick and block and timber frame.

But what is an ICF? The forms consist of two stay-in-place panels of expanded polystyrene. The best engineered systems are connected with an innovative folding web which minimises wastage and offers greatest flexibility. The forms are transported flat to site, opened and stacked, reinforcement placed, propped and then filled with concrete, creating a solid monolithic concrete wall for above and below ground applications.

ICFs offer great durability and strength; for example, a 15cm core wall can be designed to heights up to 4.3m within a single storey. ICF structures have been built up to 25 storeys in height, making them ideal for hotels and skyscrapers.

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Curly House was designed by Ecotecture architects to Passivhaus and built in ICF after a two-storey timber frame Passivhaus build had been refused planning in an AONB

This 410 sq m crescent-shaped, contemporary, low-energy home (above) steps and slides into the slopes on the West Sussex site. ICFs are highly suited for both complex and curved structures and the same system can be used for below and above grade walls

Concrete is poured into the formwork (right) creating the floor and walls as a continuous element. The best ICFs allow the concrete to be vibrated within the formwork to ensure that there are no voids in the wall

Six building steps are completed within one product: form and wall structure, insulation, air and vapour barriers, and the interior and exterior finish anchorage.

So ICFs are the perfect partner to fast track construction programmes and the savings in terms of time and labour speak for themselves. The largest and most advanced ICFs available make building measurably easier and faster. Building in traditional brick and block, a wall 2.75m high x 7.3m long without openings would typically be erected by three men in 16 hours with a total labour time of 48 hours.

Using ICF technology, the same wall can be erected and poured in five hours by two men utilising only 10 hours' labour, so there's almost an 80 per cent saving on labour costs. The best ICFs are 50 per cent faster than concrete cavity construction and require as low as 0.5 man-hours/m^2.

Size does matter and premier products are typically larger than standard systems. They consist of two panels up to 70 mm in thickness and are connected together by an industry-leading interlocking web design. Site waste is 50 per cent less than cavity block and when compared to other ICFs, this system offers waste levels as low as one per cent, thanks to a four-way reversible design. When the form is able to be folded, this reduces installations times, increases transport capacity by up to 40 per cent and decreases the amount of space required for on-site storage.

'Using ICF technology, the same wall can be erected and poured in five hours by two men utilising only 10 hours' labour, so there's almost an 80 per cent saving on labour costs. The best ICFs are 50 per cent faster than concrete cavity construction and require as low as 0.5 man-hours/m^2'

The main benefits explained

Energy efficiency: ICF structures greatly reduce air infiltration, which optimises energy performance and offer excellent thermal bridging values. The best forms on the market, when combined with the structural strength and thermal mass of concrete, can provide U-values as low 0.11, meeting and exceeding Passivhaus/Code for Sustainable Homes. This can save building owners up to 70 per cent in energy costs.

Fire resistance: ICF structures offer maximum safety with a fire protection rating of up to four hours. With an ICF structure, walls are built with steel reinforced concrete and the forms are manufactured with a non-toxic fire retardant expanded polystyrene foam to ensure maximum safety.

Acoustic performance: ICF structures act as an effective sound barrier, filtering out unwanted noise, dampening sound vibrations from outside noise creating comfortable working or living spaces for occupants. ICF systems offer superior building comfort via excellent Sound Reduction Indexes when combined with a gypsum wall board finish and an exterior finish of acrylic/silicon render. Walls can be easily modified to achieve an SRI of SRI 72 (STC71) if the project requires.

Strength: ICF buildings provide greater impact resistance and will withstand winds of up to 250mph so building occupants are safe and secure in almost any situation. The strength of the ICF wall comes from the solid concrete core.

A specifiers guide to building boards in cladding applications

Ian Quinton, managing director of RCM – suppliers of building boards and facade solutions to some of the UK's most prestigious developments – outlines the key criteria to consider when specifying building boards and cladding solutions

In order to select the right product for the right application, you need to be supplied with the right technical information, not a glossy, uninformative brochure. As design professionals you require robust, well-researched and certified technical information, including classification, performance and installation details. Simple but so very often overlooked.

The NBS National BIM Report 2014 reveals that 90 per cent of specifiers find product inclusion in NBS BIM useful – they of course would say this, however, as one of the few building board suppliers to use this specification system – RCM is a great advocate. Product information authorised by NBS enables professionals to specify with ease – crucial in early stage concept calculations and specifying decisions.

Even when specialist advice is available, a working knowledge of regulations and performance is fundamental to making the right specification decisions – here are just six key points for consideration.

Technical approval

Specifying systems with a credible certification provides reassurance and confidence to specifiers. BBA, for example, offers full technical approval for construction products and is recognised by building control, government departments, architects, local authorities, specifiers and building insurers. BBA Approval provides architects, designers and contractors with certified information when specifying or installing building board products.

Approval includes:

- Factors relating to compliance with Building Regulations
- Factors relating to additional non-regulatory information
- Independently verified technical specification
- Assessment criteria and technical investigations
- Design considerations
- Installation guidance
- Regular surveillance of production
- Formal three-yearly review

A generic standard for the evaluation of building boards to also consider is BN EN13986 2004, which explores characteristics, conformity and marking for use in construction.

Structural strength and stability

A significant consideration when assessing building boards is to ensure the optimum racking performance to enhance structural strength. For example, European norm – BS EN 594:2011 – is the recognised testing protocol for testing racking strength and stiffness of timber frame wall panels. Building boards and cladding systems with BS EN 594:2011 certification have been rigorously tested and offer good racking, performance, structural strength and stability.

Another factor to consider for stability is moisture movement. When evaluating a solution, consider a system that offers a high level of dimensional stability with limited moisture movement. Building boards can be specified with as little as 0.06 per cent moisture movement.

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Resistance to moisture and durability

By specifying a building board that is fully tested to BS EN 1062-1, it ensures the boards have adequate moisture resistance and durability and will have a life equal to that of the building.

Selecting a building board with good external performance and durability is important, particularly through the build phase, as the product may be left exposed for several months prior to a secondary facade being installed and enclosing the sheathing board.

Testing and certification to BS EN 12467:2012 also offers confidence of the building board's durability requirement and that it can withstand the exposure cycle of freeze and thaw, heat and rain.

'Specifying systems with a credible certification provides reassurance and confidence to specifiers'

Behaviour in relation to fire

The building regulations for England and Wales set out the legal obligations for building designers. These functional requirements outline what must be done, but do not address how to achieve this. An example of a functional requirement that covers structural stability in a fire is that 'the building shall be designed and constructed so that, in the event of a fire, its stability will be maintained for a reasonable period.'

Companies with recognised certified products generally make technical information readily available and the material safety data sheet for building boards and external cladding systems is a good starting point.

Fire Rating A1 and A2 refers to reaction-to-fire classifications for contribution to fire growth in accordance with BS EN 13501-1. A1 utilises BS EN ISO 1182 and BS EN ISO 1716 tests and is typically non-combustible rating referenced as 'non-combustible'. A2 utilises BS EN ISO 1716 andBS EN 13823 testing and is referenced to typically as 'limited combustible.'

CE marking

CE marking is a manufacturer's declaration that the product meets the requirements of the applicable EC directives in terms of safety, health and environmental requirements. CE marked buildings boards appear under the harmonised standard of BS EN 12467:2012. Demonstrating that the manufacturer has checked that these products meet EU safety, health and environmental requirements is a key indicator of a products compliance with EU legislations and allows the free movement of products within the European market.

And finally…

Develop a relationship with your supplier – they can become a trusted information source and advisor when considering a particular system or experiencing a challenging issue. Some suppliers have a wealth of knowledge and no online technical specification tool can replace first-hand experience. Many will make their expertise readily available with free training and CPD seminars. It is also a clear advantage to be involved with a company that can offer full support in providing the complete through wall solution. Building a relationship with a recognised and credible supplier will mean that specifiers will have a valuable information source 'at hand' and be kept up to date with the latest developments in building board technology.

The changing world of roofing

Ray Horwood CBE, chief executive of the National Federation of Roofing Contractors, discusses the impact of revisions to BS 5534 and the GRO code

Given the pivotal role that architects and specifiers play in the design and specification of the building envelope, it's imperative that they keep abreast of all developments within construction. As we all know, roofing impacts greatly upon the building envelope and in an ever-changing landscape of legislation for roofing, there have been two developments in particular that need careful consideration by architects – revisions to BS 5534 and the GRO code.

BS 5534

Representing the most comprehensive and far-reaching revision the roofing industry has seen in a long time, the recent changes to BS 5534 not only bring us closer to European practice, they help bring roofing into the 21st century in a simple and relevant way. The six-month crossover or co-existence period is fast coming to an end and the revised standard will become mandatory from the end of February 2015, so it's wise to get smart.

Essentially, BS 5534 has been revised to make UK roofs more secure in the face of increasingly extreme weather events. It contains changes to the way we calculate roof tile fixing requirements, new minimum performance requirements for underlay have been introduced and there is no longer any reliance placed on the strength of mortar to resist wind uplift.

NFRCED09.14

In brief, the theoretical wind loads used to calculate the mechanical fixing requirements of slates, roof tiles, ridge and hip tiles and roof systems have now increased and interlocking roof tiles now require fixings on every tile. One other change is that a manufacturer-approved adhesive will be considered a mechanical fixing. While it's not the end of mortar – yet – the new standard also demands that all ridge and hip tiles are mechanically fixed. Mortar bedding failure has become a major issue, as it leaves the ridge or hip tiles vulnerable to dislodgement.

There are also now requirements to secure lightweight underlays and prevent 'ballooning' caused by wind deflection, which pushes on the underside of the roof covering, sometimes dislodging it. A new performance requirement and test method will be introduced for underlays for resistance to wind uplift.

New GRO code

A new and updated GRO code for green roofing has recently been unveiled. Instigated by the Green Roof Organisation (GRO) and supported by NFRC, the revised code aims to provide assistance for anyone who is involved in the design, specification, installation or maintenance of a green roof.

First published in 2011, the GRO code is intended to be a code of best practice and to serve as guide for behaviour and standards relating to all matters green roofing. This latest update contains more detailed information on meeting the requirements of the London Plan Policy, together with added guidance on substrate installation and waterproofing.

The revised GRO code reflects the growing movement by councils and local authorities throughout the UK, including the London boroughs, that now expect green roofs to be designed for new developments, where feasible. As such, it provides an enhanced technical report *Living Roofs and Walls*, supporting the London Plan Policy that was first unveiled in 2008. This document provides guidance in helping London combat the effects of climate change and recognises that green roofs have the potential to improve London's resilience to climate change by reducing storm water run-off velocity and volumes, and by increasing the cooling effect during London's hotter summers. They also bring many other wider environmental benefits.

Regarding green roof substrate installation, the revised Code also provides guidance on the size of substrate sacks required for certain projects and states that they should be disposed of once the substrate has been discharged at roof level. The method choice of lifting the substrate up to the roof level, and its subsequent dispersion of it across the roof, has significant access, budgetary and scheduling implications and is subject to the size of project. Substrate should be applied to the required

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The recent changes not only bring us closer to European practice, they help bring roofing into the 21st century in a simple and relevant way'

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depth (including the appropriate settlement volume) using grading bars. Depth checking should be undertaken throughout the installation.

When it comes to waterproofing, the revised code now states that in all applications the primary waterproofing layer is critical to successful performance of the roof as a whole, therefore its function and performance characteristics, and its suitability for use within a green roof system must be assured.

It is important that architects are brought up to speed with these two latest developments in order to bring improved best practice across all roofing disciplines and to deliver high quality, consistent and cost-effective results on all projects across the building envelope.

If you haven't already done so, obtain a copy of the new standard – NFRC members can get discounted copies – and the new GRO code can be downloaded from **www.nfrc.co.uk**. So start protecting yourself, your practice and your roof today.

Notes from the Comar design team...

comar6EFT

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comar

Unitised facades –

How to apply modern methods of construction to the building envelope

Jon Palethorpe, commercial director of aluminium facade specialist Wicona, offers some practical advice to architects considering using unitised curtain walling solutions


© Zander Olsen-Make

Off-site construction is revolutionising the way buildings are built. More developers, architects and contractors than ever before are recognising the benefits of moving elements of the construction process into a controlled factory environment. The build process can be sped up, quality is improved and work on-site is significantly safer.

Unitised facades are designed to maximise the benefits of building off-site and allow modern methods of construction to be applied to the external envelope. These solutions offer a host of advantages:

- Programme times can be reduced by up to 70 per cent for earlier fitting out and completion
- Scaffolding can be eliminated, improving site safety
- There is greater quality control because the units are completed off-site in a controlled factory environment
- There are cost savings on site preliminaries and scaffolding
- Unitised facades allow constrained city centre sites to be developed, maximising the building footprint
- Unitised facades are more adaptable to building movement

How the approach works

Unitised facades consist of prefabricated units, which are typically one or two storeys high and of varying widths. The panels are fully glazed and sealed off-site, with gaskets and glazing beads pre-installed in factory-controlled conditions instead of on-site. The complete units are then moved to site for fast and easy installation.

The approach can be used for technically challenging projects, as well as fast track schemes, new build and refurbishment, and new designs can be developed for more complex and bespoke facades.

Unitised facades do not dictate uniformity – in fact an infinite range of design variations is possible within the facade structure, with a mix of panel sizes, colours and materials.

Conventional cladding can also be eliminated because the unitised panels can hold composite stone and cedar, for example, as well as glass.

The design process

Working with unitised facades is very different to conventional 'stick' curtain walling and requires a change of approach. For a successful project, which maximises the benefits of unitised curtain walling, it is critical that a building is designed around the facade and not vice versa.

The facade specialist should be involved at the earliest stage to design the building structure that will best accommodate the unitised facade, the required loadings and its allowable tolerances.

And the project ideally needs to be sufficiently large in scale for maximum cost efficiency. Facade projects in excess of 3,000 sq m will achieve the best economies of scale, but smaller fast track schemes or developments on sites where access is restricted, can also be accommodated with a unitised system.

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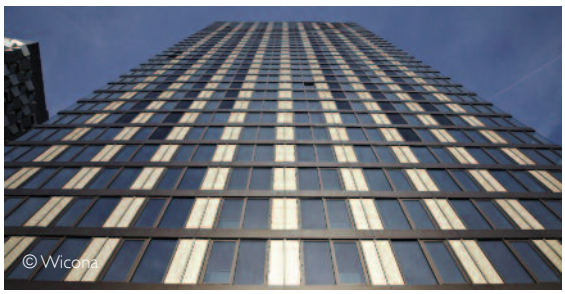
'Unitised facades do not dictate uniformity – in fact an infinite range of design variations is possible within the facade structure, with a mix of panel sizes, colours and materials'



'A single point of contact will give the benefit of a seamless approach, one point of responsibility and complete peace of mind from design to fabrication, site installation, testing and handover'

Other considerations are similar to those for conventional facade design, but because unitised solutions are faster on site, earlier specification decisions are required:

- Thermal performance – facades to reduce energy consumption
- Acoustics – the impact of acoustics floor-to-floor, between adjacent rooms on the elevation and from external sources
- Appearance – grid or structural glazing; finish colours, sight lines, infills, spans and surrounding architecture
- Fire resistance – to prevent spread of fire floor slab to facade and between adjacent dwellings
- Occupier comfort – how to optimise natural light; reducing solar gain; natural ventilation – trickle ventilation or using manually-operated or automated vents
- Maintenance and cleaning, including ease of glass replacement
- Structural implications – floor spans, panel widths, openings, fixings, barrier loadings for impact resistance, wind loadings and structural movement
- Sustainability – maximising energy efficiency, use of insulated panels and high performance glass; lifespan of the material, recyclability and recycled content

Selecting the facade partner

As with all facade projects, when selecting the system supplier, the specifier should look at the manufacturer's track record, project portfolio, financial stability, R&D resources, in-house facilities such as testing, technical back-up and design experience. The facade specialist should be willing to work as an integral part of the design team from the earliest stages and participate in design workshops.

Consider whether the facade specialist will offer a complete turnkey service. A single point of contact will give the benefit of a seamless approach, one point of responsibility and complete peace of mind from design to fabrication, site installation, testing and handover.

A team should already be in place for the facade design, abrication and installation, and the specifier should always look for independent approvals for the system and ask to see certificates and test results for verification.

Ensure facade systems are like for like when making comparisons and that the quality of components, technical competence of the team and best value are assessed. Use the facade specialist for advice and involve their team from the outset to make best use of the expertise available.

Design detailing

The design concept should be suitable for unitisation. Flat, non-projecting facades without overhangs will allow the units to be hoisted into position for fast and efficient installation.

The structural integrity and built-in tolerances of the building frame are important to the success of the facade construction and should be specified at an early stage.

Consider what the unitised panels will be fixed to at the design concept stage – steel or concrete? The fixings will also affect the design of floors and ceilings. What will the floor thicknesses be and will there be any possible deflections?

Managing the project

The true facade cost should be considered, including the advantages of reduced site time, eliminating the need for scaffolding and earlier fitting out, completion and occupation, when comparing the cost of a unitised facade against traditional curtain walling solutions.

Lastly, ensure the project is closely monitored and evaluated. Was it delivered on time and to budget? If not, why not? Use this information and the lessons learned for setting the specification for your next facade project.

What next?

The biggest challenge for specialists in unitised facades is to overcome the resistance to change among many building designers and contractors, and the misconception that unitised solutions have to be more expensive. If aesthetics are balanced with cost, an innovative, bespoke and sustainable design can be produced to a budget.

The changing face of stainless steel

Kevin Jones, business manager of Aperam Stainless Steel Service UK Ltd, explains why stainless steel is a cost-effective building envelope material and how new surface finishes and coloured grades are widening its aesthetic appeal

The increasing emphasis of design life value in commercial projects has prompted the development of metal facade and roofing systems of greater durability and lower maintenance. Despite its technical advantages, however, more widespread specification of stainless steel has been held back by the belief that it is expensive. Comparison of metal prices per tonne would certainly preclude selection in most situations but its enhanced strength means that thinner gauges are used, giving a completely different picture.

A typical minimum facade thickness for aluminium and copper is 1mm while that for zinc is 0.8mm and stainless steel just 0.5mm. Though roofing systems can be slightly thinner, a simple 300 sq m area requiring around 1 tonne of stainless steel will still weigh 1.5 tonnes or more in zinc or copper (and more than 10 tonnes in lead). In terms of large facade projects such as the new £45 million, 80,000 sq ft Marks and Spencer store on the Glasgow Fort retail development, 0.6mm stainless steel shingles specified by Cooper Cromar have saved up to 18 tonnes in facade weight. The design, described by the architects as 'an elegant stainless steel-clad box', has been designed to form a distinctive new entrance feature for the motorway frontage.

In total contrast, Wrap House (pictured) is a large 1960s family home in Godalming, Surrey, which Edgley Design was commissioned to 'upcycle'. Their ultimate proposal extended and re-articulated its strong external forms using stainless steel cladding. Such finishes are among the most commonly associated with the metal and reflections on walls of the rural landscape have brought colour and changing patterns to them throughout the day, creating a dynamic facade. This was achieved using a material with a relatively dull but uniform

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'A typical minimum facade thickness for aluminium and copper is 1mm while that for zinc is 0.8mm and stainless steel just 0.5mm'

St Barnabas Church Erdington (above) and Mirror-faced material used to good effect (right)

'The choice of visual effects which stainless steel can now provide includes linen, lozenge, leather and chequer patterns in a palette of different colours'

appearance combined with exceptional smoothness. It provides a shimmering envelope; in this case partly through use of an installation technique which creates visible waviness in flat areas of the standing seams and consequent abstraction of reflected forms. A standard mill surface was used but greater reflectivity could have been achieved by bright annealing and full mirror polishing.

The choice of visual effects which stainless steel can now provide includes linen, lozenge, leather and chequer patterns in a palette of different colours. Processes such as bead and sand blasting are used with rolling techniques which provide consistency of surface finish as well as lower cost. A roofing surface which takes on the patination of aged lead sheet has been approved by English Heritage as an alternative to lead where metal theft is considered a threat. A 0.5mm system weighing 4kg/m^2 compares with zinc at 5.04kg and lead at 30kg or more. Introduction of a nickel-free ferritic grade has also done much to enhance price stability and competitiveness without compromising performance. A material low in weight and as thin as 0.4mm can be used for standing seam, self-supporting and cleated seam systems.

The specification of compact, non-ventilated systems in warm roof build-ups has brought with it problems of underside corrosion with metals such as lead and zinc. Moisture trapped during installation or which passes through an inadequate vapour barrier provides the source for condensation to develop. Consequent failures are all the more costly as the problem invariably goes unnoticed until it is too late. Of the many reasons, therefore, why stainless steel is enjoying resurgence, its corrosion resistance in such situations is undoubtedly one of the most compelling.

Once installed, stainless steel presents no risk to potable water, rainwater harvesting systems or water run-off, and will not stain masonry or timber. It is 100 per cent recyclable which means material can be re-used to manufacture roofing, facade, rainscreen or rainwater products rather than as a raw material for other industries. An exceptionally high melting point gives high fire resistance, while tensile strength is twice that of copper and more than four times that of aluminium. Surfaces offer the benefit of extremely low surface roughness and maximum resistance to the accumulation of contaminants. For over 100 years, the metal's high performance has prompted use in the most demanding industries and environments. Outstanding corrosion resistance and design life is prompting its use in increasingly complex construction specifications and with demands for extended service life and low maintenance, stainless steel is surely set for a greater proportion of high profile projects.

Building in timber

Andrew Carpenter, chief executive of the Structural Timber Association, explains how building in timber can create a high performance building envelope

Over the past year, both the British economy and the construction sector as a whole have turned a corner, with growth returning and remaining stable. While it is important that we seize the opportunity to secure this recovery, our industry still has a number of issues it needs to tackle with regards to sustainability, such as rising energy prices and the growing drive for zero carbon. Creating a secure, air-tight building envelope will go a significant way to meeting these challenges, and timber is the ideal material to achieve this.

When constructing a building's exterior envelope, the Structural Timber Association (STA) encourages all its members to pursue a fabric first approach, where the energy performance of the building is achieved primarily through the external structure. A secure envelope helps to minimise heat-loss, placing less demand on a building's heating systems. Not only does this have the desired effect of reducing a building's carbon footprint, it also helps to keep heating bills under control – an important consideration for both business and residential occupiers, especially as energy bills continue to rise.

Taking a Fabric First approach also negates the need to install renewable technologies, including solar panels, micro wind turbines and ground source heat pumps, which are often inefficient, expensive and notoriously difficult to maintain.

Evidence also suggests that it is easier to manage performance when constructing with structural timber methods, thanks to the higher level of off-site prefabrication inherent in its manufacturing process. This is particularly the case for the junction performance, where the work done in the factory allows for greater control of the elements, and the junctions are considered before it gets to site. It is not only easier to monitor quality in the factory environment, but in addition, the all-critical insulation is positioned such that it is able to work more effectively – thereby reducing the risk of environmental conditions, or work from another trade, negatively impacting on it.

Off-site construction also allows for quality to be monitored at every stage, unlike other methods, which are reliant on a multitude of trades. Factory based activities allow for better and safer working conditions, while also protecting the workers from the changeable British climate, which is likely to lead to better quality work. There is also increasing agreement across the sector that prefabricated systems will go some way to helping reduce the gap between a building's design intent and its in-built credentials.

'A secure envelope helps to minimise heat-loss, placing less demand on a building's heating systems'

Low carbon building

Using structural timber as a way of creating a secure building envelope is an effective way of helping current and potential clients to meet their environmental targets. As an organic, non-

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'Using structural timber as a way of creating a secure building envelope is an effective way of helping current and potential clients to meet their environmental targets'

toxic and naturally renewable building material, timber is the most sustainable form of construction. In addition, the carbon dioxide produced in both its transportation and manufacture is absorbed by the tree during its lifetime. By comparison, the production of concrete and steel accounts for around eight per cent of the world's carbon dioxide emissions, due to its carbon intensive production processes.

In the longer term, buildings with secure envelopes are also the perfect fit with the low carbon agenda currently being pursued by national, regional and local governments. This includes the modifications to Part L of the Building Regulations, which require new build homes to be six per cent more efficient than under current regulations, with nine per cent uplift in the efficiency standards of non-domestic buildings. A new fabric energy efficiency target has also been introduced as part of these regulations, which timber is ideally positioned to meet. Although a number of these regulations are currently in flux and will be liable to change, utilising timber at its optimum can ensure that clients are ahead of the curve.

Without a doubt, timber delivers sustainable and energy efficient solutions – low embodied carbon, a choice of insulation performance, minimal waste, speed of construction, solutions without needing renewables, and off-site manufacture in a quality controlled environment. As the price of energy continues to rise, a building's operational performance will inevitably become something that consumers will focus on more. It is strongly believed that this will lead to a significant increase in the use of timber across all sectors and encompassing hybrid solutions, such as CLT, SIPS and glulam. When consumers start to demand energy efficient homes, the envelope of buildings will come into focus like never before, and that's something we must all be ready for.

Specifying external wall insulation

By Dr Jeremy Richings, technical director of PermaRock Products Ltd

The use of external wall insulation (EWI) is now commonplace for new buildings and for the refurbishment of existing buildings, both residential and non-residential.

By providing the insulation layer to the outside face of the primary structure the building designer can overcome many of the problems associated with cavity insulation, in particular that of thermal bridging (cold bridging), which occurs whenever a material of higher thermal conductivity passes through an insulation layer or wherever there is a break in the insulation continuity, a frequent problem encountered in both traditional cavity walls and in frame constructions.

In the former, insulation continuity might be interrupted at heads and jambs of windows as a result of the building design, and thermal continuity might be compromised because of poor installation resulting in gaps in the insulation layer. Gaps between insulation boards inside a cavity wall are not visible and are not readily rectified, so such cold bridges can go

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'For those projects where the highest performance in relation to fire is seen as being of paramount importance specifiers might be advised to consider the fire performance of the insulation material alongside its thermal performance characteristics'

undetected and will result in the building exhibiting much higher rates of heat loss than the design might suggest.

The use of EWI, on the other hand, places the insulation externally so that thermal continuity is easier to achieve. Furthermore, there is usually more scope for introducing thicker insulation layers to the outer face of the wall than into a cavity and therefore higher levels of thermal resistance, and hence lower wall U-values, can be achieved. The use of EWI on solid masonry walls is therefore a favoured approach to achieving the high thermal performance requirements for walls of passivhaus designed buildings.

All is not necessarily straightforward, however, and specifiers of EWI should understand some of the other factors that should be considered before settling on a specific EWI system.

EWI systems can incorporate a number of different insulation material types, including synthetic foam materials such as phenolic, polyisocyanurate (PIR) and expanded or extruded polystyrene (EPS and XPS respectively) or mineral-based materials such as stone wool. Generally the synthetics are lower thermal conductivity materials than their stone wool counterparts and may therefore be advantageous in terms of their thermal performance, but the mineral/stone fibre types offer superior fire performance and may therefore be looked upon more favourably by the building insurer. For those projects where the highest performance in relation to fire is seen as being of paramount importance specifiers might be advised to consider the fire performance of the insulation material alongside its thermal performance characteristics.

Insulation materials for EWI generally take the form of rigid boards or batts, and these can be fixed to the substrate using a number of different methods. Ideally the insulation material should be fixed to the substrate so that it is in intimate contact with the substrate. Such an arrangement will reduce the phenomenon of thermal bypass whereby heat losses occur through the action of air movement behind the boards and through gaps in the insulation or at abutments. On uneven substrates it may be necessary to use adhesive to bond the insulation to the walls. Here the adhesive provides several functions: The bonded insulation has better resistance to wind suction forces since the action of wind is transferred to the wall through a greater contact area that would be the case if the boards were only mechanically fixed. The adhesive also provides a levelling function, enabling the unevenness of the substrate to be overcome, as well as blocking the path for convective heat losses behind the insulation boards.

In some cases, however, the incorporation of a drainage cavity behind the insulation layer is a requirement of the building insurer. A cavity placed behind an insulation layer is counter intuitive since it invites heat loss by convection. It is essential, therefore, for any such cavity to be carefully designed so that a free flow of air through the cavity cannot occur. The cavity may have drainage holes at the base but openings elsewhere must be avoided if the thermal performance of the insulation layer is not to be compromised further. If cavities extend over several storeys provision will have to be made to prevent the risk of the spread of fire through the cavity, while maintaining the drainage requirements of the building insurer. The incorporation of intumescent cavity fire barriers can provide a way of achieving this.

In terms of the aesthetics of EWI systems, synthetic renders are now available is a very wide range of colours and textures and now include metallic or lustrous effects. Specifiers should be mindful of the fact that not all colours, and indeed not all render types, have the same durability, in particular in relation to colour fastness and fade resistance. All exterior coatings achieve their colour through the incorporation of coloured pigments. These might be synthesised organic materials or inorganic mineral based pigments. Generally, those pigments which have their origins in naturally occurring minerals will have superior resistance to the potentially damaging effects of ultra violet light and their pigments will exhibit better colour retention and a lower tendency to face that synthetic pigments. The resistance to UV of the binder component will also affect the colour fastness of the decorative finish, and therefore specifiers should look carefully at the type of product that are specifying and should ensure, when selecting colours for render finishes, that the colour required can be achieved in a product that has the highest resistance to fading, both in terms of the pigment content and the binder.

Comar 6EFT – curtain walling

Due to demand from its architectural and fabricator clients, Comar Architectural Aluminium Systems is pleased to launch additional new mullions and transoms for its innovative Comar 6EFT curtain wall system, with the highest Ix and Iy values available on the market today. As Comar 6EFT has developed to be one of the specifiers preferred system in the UK, demands for larger transom spans in excess of 3,000mm and unsupported multi-storey mullions are a possibility. Where there are different glazed areas in the same envelope we have also extruded high span mullions and transoms in the most popular box sizes, which mean that the same box size can be used throughout the project to ensure that all fixing and plaster lines throughout the facade are continuous.

Today's design complexity, requirements for aesthetics and complex building shapes are key considerations. Aluminium offers the unique advantage of easily being extruded and manufactured into almost any custom shape with ease. With the current focus on energy efficiency,

designs must also take into account 'thermal' criteria and thermal breaks are incorporated. These breaks provide a significant decrease in the thermal conductivity of the curtain walling. The science of curtain walls now means that aspects such as thermal expansion and contraction, building movement, water diversion and thermal efficiency for cost effective heating, cooling and the lighting of a building are in-built to the system and its design.

To provide a flexible approach to aluminium facade engineering Comar's 6EFT curtain walling system utilises European wide design and extrusion expertise with Comar's market leading supply, support and delivery. With its exceptional design flexibility, Comar 6EFT provides high performance solutions for both new build and refurbishment facades. It is a flexible standardised system that provides bespoke solutions. Comar's 6EFT delivers capped curtain walling with 50mm standardised sightlines and includes options for:

- Four sided structural glazing which achieves a cutting edge facade with no visible aluminium sight lines
- Two sided structural glazing with horizontal or vertical capping, concealed vents where a feature and bespoke finish can be achieved through a variety of cover caps
- Concealed vents all systems can include side r top hung opening vents
- Facetted glazing options for all systems are available in 7.5º increments both convex and concave

0208 685 9685
www.comar-alu.co.uk

VMZINC launches engraved facade

In response to feedback from over 400 architects, **VMZINC** has once again pioneered a new development with AZENGAR®, the first rolled zinc facade and roofing material to be engraved. Its subtle yet distinctive surface has a matt appearance which is unaffected by fingerprints and therefore ideal for both exterior and interior use. AZENGAR is pigment-free, manufactured using an entirely new process and produced in 0.7, 0.8 and 1mm thicknesses. It is the lightest shade of zinc available and unlike pre-weathered shades such as QUARTZ-ZINC® and PIGMENTO, its engraving causes delicate variations in light refraction.

01992 822288 www.vmzinc.co.uk

Latest innovations in building envelope design

CA Group Limited has completed work on a 30,000 sq m distribution centre at Prologis Park, Dunstable, showcasing some of the latest innovations in building envelope design. The distribution centre incorporates CA Group's Twin-Therm® Cerberus curved roof, which was chosen not only because of its aesthetic appeal, but also as a result of its sustainable credentials. The design of the curved roof reduces the amount of 'dead space' within the warehouse, together with the associated heating costs and CO_2 emissions. These savings are further boosted by the introduction of in-plane roof lights.

01388 834242 www.cagroupltd.co.uk

Metalline ahead with high quality solutions

Metalline has become one of the market leading manufacturers for the supply of high quality anodised aluminium insulated panels, pressings, soffits and rainscreen facades. With architects and designers increasingly looking for distinctive and high quality finishes, Metalline's close working relationship with United Anodisers and the use of superior grade J57S aluminium sheet has helped it create a prestigious solution. Available in a full range of Anolok finishes specifiers are now able to enhance the aesthetic look and feel of a building's facade in a choice of colours.

01543 456 930 www.metalline.co.uk

Lighting up research

The Design Prototyping and Testing Centre in Rotherham's Advanced Manufacturing Park was founded by the University of Sheffield in association with companies such as Boeing and Rolls Royce. It was built to establish new standards for manufacturing research facilities worldwide. Designed by Bond Bryan architects, the building's BREEAM Excellent rating was achieved using Kalwall® translucent wall cladding from **Structura UK**. Widely used for cladding and roofing, the highly insulating Kalwall system is unique in the way in which it transmits Museum-Quality Daylighting™, flooding the interior with natural diffused daylight while reducing the reliance on artificial lighting.

01233 501504 www.structura-uk.com/kalwall

Innovation in lifting from Hird

Challenging new building designs need new facade construction techniques. That is why equipment supplied by Hird, such as the Winlet glazing robot, is in such strong demand.

Mini crane, glazing installation and powered access specialist Hird is an authorised UK and Ireland dealer for Winlet glazing robots, which one client has called 'the biggest step forward in glass installation in 10 years'.

The Danish glazing robot, available for hire or sale, is compact, light and easy to move. It can lift, carry and place – with absolute precision – glass sheets or any other non-porous panels up to 600kg, even overhead.

Hird Director John Wilding said: "Winlet has proven to increase production by 50 per cent on a range of sites, including high-rise towers in London. As well as being faster, it's safer and uses smaller installation teams."

The Winlet is just one powerful range of machines offered by Hird. The company is a UK leader in hiring mini cranes, including Valla pick and carry cranes and UNIC spider cranes, both ideal for building facade construction.

Hird also has an unrivalled selection of vacuum lifters for hire, for flat or curved sheets, and loads up to 2,000kg – plus a full range of powered access machines. "We aim to be a one-stop-shop for lifting, anywhere in UK," says Wilding.

0203 174 0658 www.hird.co.uk

Klober airtightness for 17th century barn

Klober roofing airtightness accessories have been specified by Danks Badnell Architects for the conversion of 17th century Brettenham Barn in Surrey. A steel frame was fitted within the original structure, with Wallint 50 air barrier used to 'wrap' the property. Permo TR and Easy-Form tapes were also used to seal laps and joints of the building, which was reroofed to meet current Building Regulations using Permo air roofing underlay. Neil Oakley of Danks Badnell commented: "We had previously specified Klober airtightness accessories as they provide a complete package [...] this enabled us to achieve the high standard of performance we required."

01332 813050 www.klober.co.uk

VIVIX® panels used for St. James's facade

VIVIX® by **Formica Group** exterior facade panels have been used for the external wall cladding of St. James's hospital in Dublin. Equator European Architects specified VIVIX panels in Redwood from the Woods range to create a contemporary look. The range of cladding solutions available means that the choice of materials for exterior cladding is not only decorative, but also practical, functional and can contribute to how the building as a whole performs. VIVIX panels are resistant to impact and abrasion, are weather resistant and can help to enhance the lifespan of a building.

0191 259 3512 www.formica.com

Weatherproof dual coat render systems

A range of dual coat render systems designed to provide bright, long-lasting, weatherproof exterior finishes to new masonry or framed structures, in a variety of surface textures and over 500 colour options, is available from **Knauf**. Comprising a basecoat, reinforcing mesh and through-coloured topcoat finish, the key to the system's success lies in the selection of the correct basecoat to match the strength of the substrate. For medium or dense blockwork, the Knauf solution is a basecoat of its UP210 lime/cement-based render with complementary UP310 fine aggregate render for plinth areas, where high impact resistance is required. Both can be applied by hand or machine.

0117 982 1042 www.marmorit.co.uk

Denbury Mews gets a natural finish

The requirement for good quality, low maintenance and an aesthetically pleasing end result led to **Cembrit's** Contessa natural slates being specified for Denbury Mews, a new unique development in Devon. The slates have ensured a high class appearance for the fifteen houses and coach houses and the product's versatility was the perfect answer to the challenges posed by the curved roof. "Due to the nature of this project with some of the roofs being at a curved angle, we required a good quality slate that would allow us to cut on-site all four edges, without shattering," said Chris Perrin, owner of Perrin Construction. "Having worked with Cembrit's Contessa slates in the past, we knew that these slates would be suitable for this project."

St. Johns School, Marlborough

This new secondary school was completed in December 2010 to replace former 'split' site buildings. Re-Format designed a new sedum roof construction that follows the curvature of the site to give the impression of the landscape being raised to accommodate the school below. The cladding used **Follansbee's** KlassicKolor material, which contrasts with the adjoining facades to create an exciting pallet of surface finishes. The coating is formulated with a 'cool roof' concept and uses pigments with enhanced solar reflectance and emittance, to reduce the energy needed to cool the building.

Kladfix supports student housing

Kladfix, a rainscreen cladding support system specialist, has supplied KX01 fittings for a new development on Sefton Street, Liverpool. The £15 million student accommodation consists of 135 new halls for the University of Liverpool and is situated in the heart of the city centre, overlooking the Queen's Dock. To provide a unique exterior, four different types of rainscreen cladding have been specified; zinc, terracotta, engineered stone and granite. Indbuild, the industrial building company installed Kladfix's KX01 cladding support system for this project. "The KX01 system worked extremely well with all the different types of cladding and was easily installed," commented Dave Kirby, managing director of Indbuild Limited.

To clad or not to clad? That is the question

NVELOPE NV1 vertical cladding support systems have been installed on a newly refurbished apartment block in Hackney to provide an attractive external envelope that regenerates the area. Shakespeare House has been transformed from a low quality housing block into 18 modern apartments. Redesigned to create spacious living areas, the building has been completely insulated to improve energy. Bptw Architecture aimed to add a contemporary feel to the housing and decided to overclad the building with an attractive Corium brick cladding system. To enable them to do so, a versatile cladding support system was required. The building was extended to provide a fourth floor.

Rebrand for Airtec

Airtec Stone and Airtec Glass ventilated rainscreen facade systems have been rebranded under the Lithodecor banner. The Airtec systems have been manufactured by Lithodecor for over 20 years and marketed alongside **alsecco's** insulated facade systems. The rebranding to Lithodecor allows for the specific technical and design aspects of the systems to be highlighted more clearly and give more impetus to this innovative, specialist stand-alone range. The Lithodecor team offers full technical and design support from inception to installation and is able to support you with relevant information such as detail drawings in dwg and pdf format, data sheets and approval certificates.

01785 818998 www.lithodecor.co.uk

Cembrit clads sustainable homes

Cembrit Metro cladding has been installed on a mixed-use development in the heart of Camden, London, to provide a decorative finish to complement the surrounding brickwork. Approximately 500 sq m of Stockholm cladding has contributed to the building achieving an accredited sustainability status. London-based architect Allford Hall Monaghan Morris (AHMM) specified Cembrit's Metro cladding with the design plan of the brickwork 'peeling back' at the corners of the envelope, revealing a contrasting palette of glazing and cladding. Drylining and facades specialist Conneely Group installed the cladding onto the new build project and found the material particularly easy to handle.

Lathams' latest cladding gets TRADA approval

Accoya®LathamCLAD – the modified, highly durable and dimensionally stable certified timber cladding – is now available from all eight of **James Latham's** timber depots. Created from sustainably sourced wood and completely non-toxic, Accoya®LathamCLAD is a revolution in wood technology. And with the 15mm profile having recently received TRADA approval for use as an external cladding product, Accoya®LathamCLAD is a perfect solution for exterior cladding, siding and facades where the wider board offers numerous features and benefits including enhanced aesthetics, less frequent maintenance, dimensional stability, durability and improved insulation values. Suitable for horizontal or vertical installation, Accoya®LathamCLAD can be used to create simple or complex designs. And with a choice of factory coating finishes, it can be opaque coated or, for those wishing to enjoy the natural look of wood, translucent coated. Plus, with a 50-year guarantee when used externally, Accoya®LathamCLAD's low maintenance requirements add to its 'whole life' cost effectiveness and environmental credentials and this versatility makes it ideal for use in residential, commercial and industrial applications. ACCOYA® and the Trimarque Device are registered trademarks owned by Titan Wood Limited, a wholly owned subsidiary of Accsys Technologies PLC, and may not be used or reproduced without written permission.

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