

Glass & translucent materials

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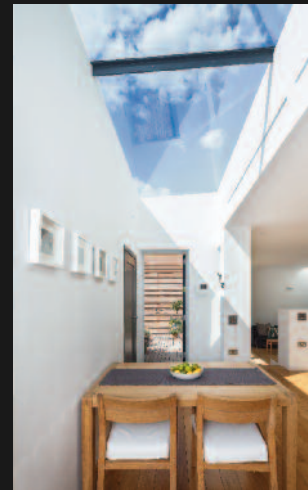
Louis Vuitton Moët
Hennessy Foundation
for Creation, Paris

London's historic
Mount Pleasant Mail Centre

An altogether different glass

Plus more projects, news
and latest information from
industry associations and
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Cover image: Collage using images from projects and features see pages 17, 23, 29, 35, 39, 42, 45 and 47 for more.

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With an increased preoccupation with creating more energy-efficient buildings, skylight manufacturers have seen a heightened demand for intelligent glazing solutions. But how do the flat roof skylights fair in comparison to their window counterparts? Justin Seldis, managing director of skylight manufacturer, Sunsquare, gives his view

47 The design options for internal glazing

The design options available for internal glazing are as wide as the design options available on the external face of a building, but there are two clear trends emerging at the moment and they sit at opposite ends of the design spectrum. IQ Glass explores these trends

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Editor's letter



Following the successful launch of ADF's supplements with Glass & Translucent Materials in May 2014, I am delighted to kick-off 2015's new season of supplements by bringing you a second edition about this architecturally important group of materials.

Glass has come a long way from when it was first made to glaze stone beads and then form glass beads in around 2,500 BC. It has certainly come a long way from when medieval glass windows were first fashioned.

Still an essentially decorative yet functional material, today glass and translucent materials in buildings must meet aesthetic, structural, environmental and safety aspects of sometimes immense architectural projects. For example, Frank Gehry's recent Louis Vuitton Moët Hennessy Foundation for Creation in Paris is a structurally daring project featuring 12 giant glass and steel sails. As we were interested to learn more about the challenges faced by those involved, journalist Stephen Cousins went to Paris to interview project director, Nicholas Paschal, and report on his findings for this supplement.

And from a new iconic building to an older one: the redevelopment of London's historic Mount Pleasant Mail Centre and the resulting lighter, brighter new centre for Royal Mail in London caught our eye. Steve Menary therefore brings us a special report on how new materials have complemented the project.

However, as the UK international terror threat level has been raised from substantial to severe, glass in busy public spaces is under the spotlight. Which is why we take a close look at safety and security glazing in places such as modern railway stations with the help of Ray Philpott, who talks to those who are designing buildings to maximise light and safety and using the latest, explosive-resistant glass.

We also bring you features from experts in their field and cover the rise in aluminium curtain walling systems, why the skylight industry is no longer in the dark, polycarbonate compared with glass in overhead glazing, daylighting technology and decorative glass for interiors.

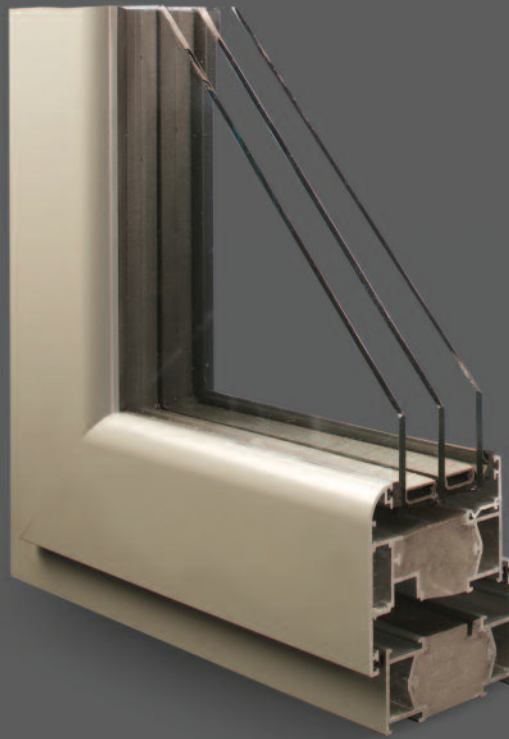
Plus, I am very pleased to inform you that we plan more ADF special supplements with bi-monthly editions including new topics.

See you soon!

Sarah Johnson

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REDEVELOPMENT

Bubl  officially launches Broadway Malyan-designed ‘Barclaycard Arena’



‘The most dramatic element of the refurbishment is the brand new glass facade overlooking the Brindleyplace canal side development’

Following a substantial 18 month, £26 million redevelopment, the National Indoor Arena in Birmingham, UK, has been officially launched as the Barclaycard Arena – with architecture, urbanism and design practice Broadway Malyan having delivered architecture, landscape architecture and interior design services.

With state-of-the-art facilities, improvements including improved seating, a fast payment system and a stunning facade, the Barclaycard Arena is a world-class venue in the heart of Birmingham, offering a world class customer experience.

Thousands attended the launch of the Barclaycard Arena, which saw a sell-out show from multi-platinum Grammy award winner Michael Bubl , who opened the curtain on a new generation for the Arena by performing to a crowd of almost 16,000 fans, including stars of sport and entertainment.

The most dramatic element of the refurbishment is the brand new glass facade overlooking the Brindleyplace canal side development, which includes a dramatic LCD ‘wonderwall’, distinctive copper fins and iconic Sky Needles – all of which create a dynamic sense of arrival for visitors and a focal point in the centre of Birmingham.

All areas of the arena have been upgraded in the redevelopment

– from the front of house through to the backstage – adding 5,926m² of pre/post show space into the 13,437m² of redevelopment.

Birmingham-based Neil Rose, Director at Broadway Malyan said: “Working in close partnership with our client, the NEC Group, our expert design team has delivered a new world-class venue in the Barclaycard Arena.

“By cloaking the Arena’s canal-side elevation with an elegant glass facade, which affords four storeys of new bars and restaurants dramatic views over the city, we have been able to project the excitement of the bustling activity going on inside the venue.

“The official launch will see the project joining our portfolio of high-profile and completed schemes in Birmingham – which includes Bournville College and Edgbaston Stadium – with our team also currently delivering the new Adagio aparthotel in the Beorma Quarter, Digbeth.”

Earlier in 2014 Broadway Malyan celebrated the completion of the 25,000-seat ‘Hassa Bin Zayed Stadium’ in Al Ain, UAE, which is part of a wider 1.5m² foot mixed use development masterplanned and designed by the practice, as well as the iconic 9,000-seat National Gymnastics Arena in Azerbaijan.

Glass skylights



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| Pyramid | ● | ● | ● | ● |
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NEW HEADQUARTERS

Magnificent double skin glass facade created using Wicona glazing systems

'The envelope of the seven-storey building is entirely glazed using Wicona's facade systems, which reveal its environmental and technical quality and give it a unique appearance'



The new headquarters for the publishing group, Tamedia, features specially-adapted aluminium glazing systems from Wicona, which have helped to create a magnificent and highly sustainable glass and timber building in the heart of Zurich's media district.

Designed by one of Japan's leading architects, Shigeru Ban, the scheme successfully brings together the simplicity of traditional Japanese architecture and western building styles to create a genuinely unique building that contributes to the corporate image of the media group and reflects its ethos of transparency and innovation.

The building's design had to follow Switzerland's stringent energy regulations and conform to local height and perimeter development restrictions. The result is an impressive carbon neutral scheme which has a highly innovative prefabricated timber structure. This was precision engineered and assembled without the need for any fixings. The beautiful interlocking structure was milled from 2,000 sq m of spruce and is visible throughout the building, giving the scheme a special character

and adding high spatial quality to the office environment.

The envelope of the seven-storey building is entirely glazed using Wicona's facade systems, which reveal its environmental and technical quality and give it a unique appearance. A 3m deep double skin facade for the 50m long elevation with views over the River Sihl successfully balances weather performance with the need for natural ventilation.

A unique feature of the scheme is a series of 'retractable windows' that transform a number of lounge spaces – some of which span two floors – into open air terraces and balconies, reinforcing the link between the building's interior and its surroundings.

Wicona also supplied solar shading using fixed aluminium louvres and sloped glazing around the perimeter roof level of the building, which complements the rest of the envelope.

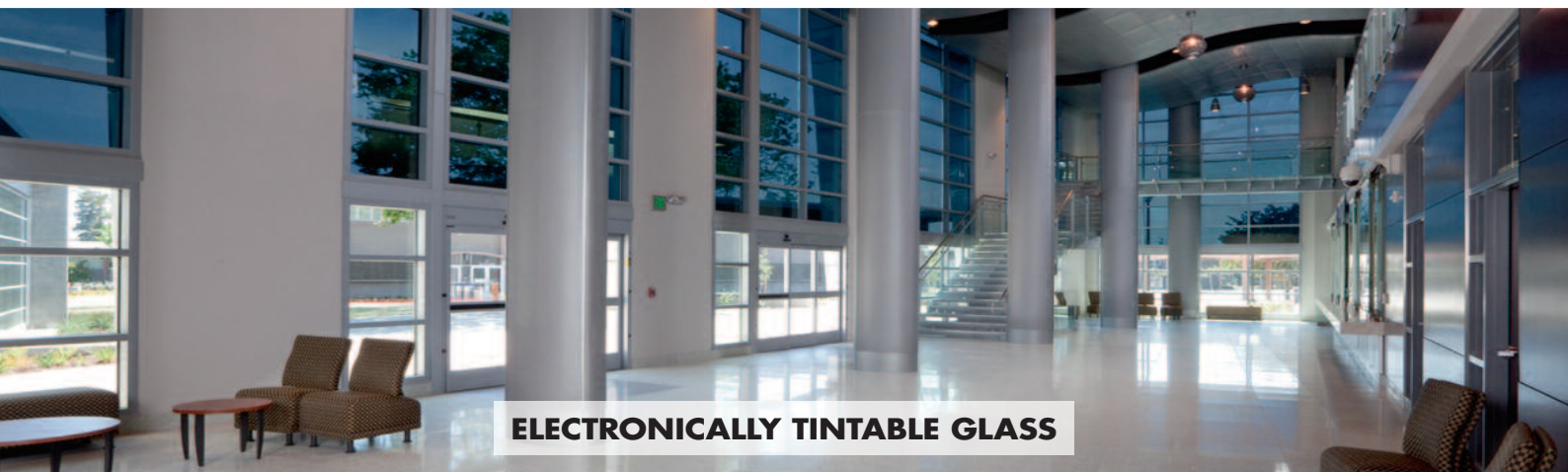
Low energy glass was specified to meet the project's stringent sustainability criteria. Other environmental features of the building include heating and cooling using geothermal ground-water and high levels of thermal insulation.



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CONSTRUCTION

Stade Vélodrome, Marseille: Bouygues construction is to build the Prado Shopping Centre



Cirmad Grand Sud, the Bouygues Construction property development subsidiary active in south-eastern France, is launching works on the Prado Shopping Centre in Marseille. This project worth more than €90 million will be carried out on behalf of the owner, Klépierre, the company that recently acquired, jointly with a privately-owned real estate investment vehicle, the Massalia Shopping Mall investment company from Doughty Hanson.

Alain Loyer, director of Cirmad Grand-Sud and Chairman and CEO of GFC Construction, the Bouygues Construction subsidiary that operates in south-eastern France, said: "Through this shopping centre, we are taking part in the creation of the sustainable residential neighbourhood surrounding Marseille's Stade Vélodrome football stadium, which was built

by our teams. The neighbourhood will include homes, an office complex, a hotel and a health centre, all helping meet the needs of the city."

With a surface area of roughly 23,000m², the shopping centre is part of the property complex accompanying the Stade Vélodrome football stadium in Marseille. Designed by two firms of architects, Benoy and Didier Rogeon, it will incorporate a department store, a hypermarket, numerous medium-size retail outlets and local traders. It will consist of two buildings (the main building and the Michelet building) on either side of an avenue open to the outside and covered by a canopy protecting it from bad weather and constituting a fifth facade. The canopy, constructed in glass on a steel structure, will be "draped" over the shopping centre and its curved forms will partly hang down over the facades. The avenue opening to the outside will function as a shopping street with corner entrances offering views of all the shopping floors in the centre.

The project is in line with the principles of construction durable and will seek the BREEAM® Excellent label and C2C ("cradle to cradle") certification, which is based on the precepts of the circular economy: zero pollution and 100 per cent recycling. The works, which will be carried out by GFC Construction and will involve more than 200 people at peak periods, are to begin immediately and are scheduled to last 35 months. Bouygues Construction is responsible for building shopping centres in France and all round the world. The Group recently handed over Kallang Wave shopping centre, which is incorporated into the Singapore Sports Hub (the world's largest sports PPP). It has also constructed the Beaugrenelle shopping centre in Paris, a flagship project with regard to the conservation of urban biodiversity, as well as the Le Millénaire shopping centre in Aubervilliers, just outside Paris.

news bytes

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NEW INSTALLATION

Beginning of the 33 photovoltaic skylights installation at the Viracopos Airport in Sao Paulo



'This photovoltaic low emissivity glass is being installed on the building's roof as 33 skylights'

The photovoltaic Low-e glass of Onyx Solar will transform the new terminal at this modern airport, one of the largest in South America, in a building that generates its own energy from the sun.

Onyx Solar has provided the International Airport of Viracopos-Campinas with more than 4,000 photovoltaic glass units which will cover a total area of 3,240 sq m. The photovoltaic installation will reach a total capacity of 117 kWp. The project at this incredible Brazilian airport signifies the largest South American project yet for Onyx Solar.

This photovoltaic low emissivity glass is being installed on the building's roof as 33 skylights. The beneficial characteristics include its semi-transparency to allow the diffusing of the sunlight; protection against solar radiations (UV & IR); and thermal and acoustic insulations. Due to the nature of the continuous flow of aircrafts in the vicinity, the acoustic insulation has a great deal of importance.

The Viracopos International Airport is located in the city of Campinas, an important Brazilian centre of scientific, technological, and industrial development, part of São Paulo. Known for harboring major university centres, the city has an access to

the best roads in the country and has a large industrial park in its metropolitan area.

Viracopos, the second largest cargo terminal in Brazil, has been experiencing a significant increase in the passenger transportation over the recent years. It is one of the fastest growing airports in the country. The goal of the Viracopos International Airport is to become the largest and most modern airport in Latin America with the capacity of receiving 25 million passengers annually.





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TRANSPORTATION PROJECT

HOK-Designed Anaheim Regional Transportation Intermodal Center opens in Southern California

'By using BIM, we were able to optimise and coordinate the precise geometry of the vaulted diagrid shell, ETFE facade technology, metal panel rain screen systems and glass'

Albert Kaneshiro, AIA, LEED AP,
HOK's project manager

The new Anaheim Regional Transportation Intermodal Center (ARTIC) sets a precedent for civic-minded transit hubs in the United States. HOK designed ARTIC, which represents the next generation of public transportation in Southern California, as an innovative new transit station that serves as a destination in itself.

Ernest Cirangle, FAIA, LEED AP, design principal for HOK's Los Angeles office, said: "ARTIC is a community-focused building that will change how people think about public transportation.

"This iconic facility is a symbol of a new era of public transit and was only made possible because of city leaders' unwavering commitment to a contemporary and bold design."

HOK won an international competition to design the project. Officials challenged the team to create an icon that would welcome a new age of public transportation into the region.

Albert Kaneshiro, AIA, LEED AP,



HOK's project manager, said: "By using BIM, we were able to optimise and coordinate the precise geometry of the vaulted diagrid shell, ETFE facade technology, metal panel rain screen systems and glass.

"BIM allowed us to match ETFE connections with the geometry of the steel in a structure that is constantly expanding and contracting."

Based on the city's goals for sustainability, the team designed ARTIC for U.S. Green Building Council LEED Platinum certification. The vault-shaped

structure acts in concert with advanced mechanical systems to optimise energy efficiency. Inflated ETFE cushions cast a soft, translucent light throughout the great hall, while the additional frit pattern on the outer layer reduces solar heat gain. Convection currents naturally ventilate the building as heat rises from the lower south end up to the north side and out through operable louvers. The radiant heating and cooling floor system and optimised HVAC system will help reduce ARTIC's energy consumption by 50 per cent.

news bytes

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GGF Pleased with Glasstec

The Glass and Glazing Federation (GGF) was pleased with the success of Glasstec Dusseldorf last year.

The GGF exhibited at the show to support its members who were visiting and exhibiting at the world's largest glass and glazing industry event.

With 1,217 exhibitors and over 43,000 trade visitors, Glasstec 2014 attracted specialists from the fields of mechanical engineering, glass manufacturing, processing and finishing, crafts, architecture/construction as well as glazing/facades and the solar sector. Glasstec has released some interesting statistics on the show:

- Over 96 per cent of the visitors give the world's

most important trade fair in the glass sector a positive overall rating

- They also rated their visit in terms of achieving their goals at the trade fair just as high
- 40 per cent of visitors came to the event with specific intentions to invest which in turn is likely to create positive impulses for the exhibitors in the coming months
- The proportion of attendees from middle and top management again improved. Over three quarters of the visitors were from these levels
- The proportion of the visitors coming to Düsseldorf from abroad reached about 60 per cent



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Gehry's Parisian Dream

Featuring 12 giant glass and steel 'sails', the £80 million Louis Vuitton Moët Hennessy Foundation for Creation in Paris is arguably Frank Gehry's most structurally daring project to date, requiring a plethora of innovative construction products and technologies to realise. Stephen Cousins reports

It has been compared to a vaporous cloud, an insect, and even a work of art by Marcel Duchamp but, for my money, the Louis Vuitton Moët Hennessy (LVMH) Foundation for Creation in Paris looks most like a flotilla of yachts. Actually, no, it looks more like a robotic organism, or maybe a set of white sheets blowing in the wind...

Perhaps there is no adequate analogy to describe this unique cultural icon, with its 12 huge glass and steel canopies that curve, twist and contort in different directions around the main 'body' of the main concrete museum building below.

If nothing else, the frenetic, smashed apart structure is a characteristic example of architect, Frank Gehry's trademark deconstructivist approach to design, which he has developed over the past 20+ years on buildings such as the career-defining Bilbao Guggenheim Museum, the Nationale-Nederlanden 'dancing house' building in Prague, Seattle's Experience Music Project, and New York City's Eight Spruce Street skyscraper. The building also reflects the grand ambitions of the project's billionaire client Bernard Arnault, CEO of one of the world's biggest luxury goods empires.

Continued overleaf...



© Iwan Baan



'The building is essentially divided into two interlocking structures, the internal reinforced concrete internal iceberg provides the primary load-bearing structure'



A number of innovative techniques and processes were utilised to design and manufacture the museum, which features 3,600 unique glass panels in the sails and 18,000 unique fibre-reinforced concrete cladding panels covering the 'iceberg', the main museum building below that houses the galleries, auditorium and restaurant.

Nicolas Paschal, project director at Fondation Louis Vuitton, told ADF: "One of the most challenging things about Gehry's buildings is that every aspect is a unique structural situation requiring a unique solution. A key idea was to keep its structural workings concealed from visitors to make them feel disoriented, which required constant dialogue between Gehry and three main structural engineers, Setec Group for the primary structure, and RFR and TESS working together to design the support for the sails and the iceberg structure."

The LVMH is located at the foot of a grand stepped water feature in the Bois de Boulogne park, Paris's second largest park on the west side of the capital. It is the latest example of the city's ongoing westerly redevelopment and, although

privately owned, it will be donated to the city after 55 years as part of Bernard Arnault's corporate commitment to promote and enhance culture in Paris.

The project faced severe local opposition, culminating in a court battle that accused the designers of infringing on local planning and conservation rules. The case was lost and construction halted in 2011, only to start up again almost 12 months later following a change in the law that allowed it special exemption for "artistic works of worldwide significance".

Rising to 43m at its highest point, the museum dwarfs the park, yet was conceived by Gehry as a sympathetic garden structure, both transparent and porous to wind and rain. The form was also inspired by Paris's tradition of ornate decorative 19th-century glass buildings and the amorphous shape of the Jardin d'Acclimatation children's amusement park next door.

The building is essentially divided into two interlocking structures, the internal reinforced concrete internal iceberg provides the primary load-bearing structure. This supports its own weight as well as a large portion of the weight from the glass sails, which comprise an intricate network of structural



© Elsworth Kelly © Fondation Louis Vuitton Marc Domage

steel columns and beams and glulam timbers.

“Early on we realised that glass is not the best envelope material for conserving art works in a gallery, so the decision was made to separate the sails from the iceberg, which is clad in fibre-reinforced concrete panels. As such, the entire building would be air and watertight even if the sails were removed,” said Paschal.

The building’s 11 galleries are relatively conventional compared to the envelope, most formed with flat walls so as not to disrupt the display of art works, although Gerhy has included certain flourishes such as unusually shaped skylights, while there is one gallery that twists upwards from a rectilinear base. Generous roof terraces located on top of the galleries are perhaps the most interesting addition, providing exciting vistas across Paris through gaps in the sails.

The sheer complexity of the museum’s design and the large number of subcontractors and consultants involved led to the development of a unique collaborative 3D model environment, known as GT Global Exchange. This allowed over 300 users to access and produce parametric model

Continued overleaf...



© Iwan Baan



© Iwan Baan

content within a shared BIM model, regardless of their location, using a range of different software tools including Digital Project, XSteel, Sketchup, Rhino, and others.

This virtual environment facilitated the creation of over 10,000 distinct archived iterations of the design model and the calculation of over 100,000,000 design optimization iterations for material and fabrication details and panellization.

The sails feature a remarkable 13,500m² of glazing, with transparent panels installed towards the base of the building and a more opaque glass towards the top, which was also fritted to prevent solar glare. Together these generate an interplay of light and shadow, also reflecting the greenery of the surrounding park.

A new glass firing technique had to be developed to manufacture the thousands of unique laminated glass panels in the sails, which each curve around different radii and in different directions.

The conventional method of bending glass by oven firing panels in individual steel moulds for several hours was rejected as too expensive and structurally inadequate because the glass would remain untempered.

An alternative type of oven was developed, in collaboration with Italian firm Sunglass, designed to heat the glass, transfer it onto a set of small wheels to impart a cylindrical form, then blow air forcefully onto the surface to temper the material.

“It was only possible to create cylindrical forms using this



technique, so Gehry Technologies' Digital Project 3D CAD design software was used to analyse the design of each unit and identify the closest cylindrical approximation. It also had to achieve a tolerance of less than 5mm between each panel to give the visual impression the glass has a freeform organic shape," said Paschal.

The columns supporting the 12 sails had to be both rigid and thickly dimensioned to limit movement, resist wind and snow loads, and accommodate a huge variety of angles where they meet the undulating surface of the iceberg structure below. "If one column supporting a sail was to break, the entire structure still had to remain solid," added Paschal.

The structure of the sail canopies also incorporates thick

larch glulam beams, some curving in two directions, their layers built up in two directions to protect against water penetration and increase homogeneous strength by counteracting natural deformities in the wood.

Gehry's design called for the glulams to be inserted between the large steel members that threatened to push the timber beyond its structural limitations. With no existing standards for calculating such extreme forces in timber, the team had to consult with a team of EU experts to validate how to calculate the loads.

The iceberg structure is clad in 18,000 totally unique pre-fabricated fibre-reinforced concrete panels that are variously truncated, curved, concave or convex to give the

The iceberg structure is clad in 18,000 totally unique pre-fabricated fibre-reinforced concrete panels that are variously truncated, curved, concave or convex to give the impression that the walls have an organic fluidity with no visible joints on the surface

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'The process is so efficient we could have effectively used a single silicon mould for the entire project'

Nicolas Paschal,
project director at
Fondation Louis Vuitton

impression that the walls have an organic fluidity with no visible joins on the surface.

The panels are made of Ductal, by Lafarge, an ultra-high performance concrete containing metal fibers designed to give it a structural strength 10 times higher than traditional concrete and enabling it to resist bending and withstand major transformations. There are no aggregates in the concrete, which gives the surface a very smooth uniform finish.

The project's engineers worked with Lafarge and other contractors specialised in moulding and prefabrication to develop a highly efficient approach to prefabricating the cladding panels. A standard 1.5m-long x 0.4m-wide silicon mould was designed, which was filled with Ductal and

covered with a unique styrofoam shape, cut using a CNC machine, on one side. The resulting block was then placed inside a vacuum-sealed bag to cure.

"The technique took several years of study and testing to make it work. The process is so efficient we could have effectively used a single silicon mould for the entire project, with the 18,000 different polystyrene shapes very cheap and quick to produce," said Paschal.

Thanks to this, and the many other boundary pushing techniques employed to build the LVMH, Paris now has an original uniquely undefinable, Frank Gehry building of its own. Which is saying something, given the geometric and structural complexity of his esteemed back catalogue.



© Technal

Mount Pleasant Mail Centre sorted

For Boyes Rees, architects working on the project to redevelop London's historic Mount Pleasant Mail Centre, the differing styles in the external envelope were to present a challenge, particularly with regard to the windows and glazing. Steve Menary reports

The Mount Pleasant Mail Centre is one of the world's oldest and largest sorting offices. Often known simply as Mount Pleasant or just 'The Mount' and situated on the borders of two London Boroughs, Islington and Camden, the centre was developed on the site of the Coldbath Fields Prison, which closed in 1885.

The first mail centre at Mount Pleasant opened four years later. Over the years, further buildings were developed at the site, particularly in the 1920s and 1930s. The architectural styles differed but the building became a

London landmark.

When Royal Mail set out to centralise their sorting offices across the EC, WC and W1 post-codes into one central London location, the Mount Pleasant Mail Centre was the obvious choice.

Historically, the scheme featured two main elements: a Letter Office Building (LOB), which comprised the main sorting and delivery offices, and the Public Office Building (POB), which contained offices and a branch of the Post Office.

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Eric McLennan, project architect on the scheme for Boyes Rees, explains: "Due to the historic context, the Post Office building was an art deco style, whereas the LOB was developed in the 1930s and had a different style. One of the driving forces for what we did was to reflect the original styles of the buildings in a modern way. The council wanted us to lift them and pick up the best historic context."

One of the aims of the project was to allow for the closure of the Rathbone Place Delivery Office in the West End and rationalise the space at Mount Pleasant to allow for three delivery offices, instead of two. The project spans three phases. The first was the redevelopment of the ground floor of the mail centre; while the second was the integration of the delivery office Head Office functions, along with facade and roof repairs. The Mail Centre is now the only one serving Central London following the closures of those at Nine Elms and Bromley-by-Bow. This centralisation of services was an extremely important part of Royal Mail's strategy for serving Central London.

A feasibility study for phase two was carried out by Faithful & Guild and then verified and reviewed by Roscoe Group, which describes its work on the project as: "A particular emphasis on interrogating the existing cost plan. Our approach was to develop a 'real time' cost plan through the utilisation of an early supply chain team to enable work packages to be benchmarked."

For a contractor, the Royal Mail appointed Mace subsidiary, Como, with work led by project director, Steve Argent. Around 500 workers were on site for most of the 18 month construction period with workers having to work around Royal Mail staff as the site had to stay open 24 hours a day.

"This project was particularly challenging because the existing Mail Centre and Delivery Offices had to remain in use throughout," adds Mr McLennan.

The building is concrete-framed with solid concrete walls. Externally, a grimy exterior was renovated as original concrete walls were stripped back and monolithic render renewed. This was overpainted with a Fosroc Dekguard system in a natural white colour. The original windows had long since been replaced by UPVC windows and for Como and Boyes Rees, the choice of window solution was to be central to ensuring the client's design specification was met.

The UPVC windows on the LOB were framed by plain spaces with mullions, but deterioration in the detailing in the surround had led to water ingress and damaged the building's fabric. Air conditioning was added to the building over the years, but most of the Mount Pleasant windows had opening lights.

Mr McLennan adds: "Historically it would have been sliding sash windows on the LOB. The opening lights are no



'Internally, the aim of the project was not just to create more space but more light. The specification of curtain walling helped alleviate the gloom as the bronze colour of the external facade system was replaced by white finishing internally'

longer required for ventilation but are needed for smoke clearance in the building, so we went for a frameless glazing option for the opening lights. We couldn't make the window spaces any bigger and we wanted to keep window appearance simple with a shadow gap around the outside. That led us down the route of curtain walling as the most appropriate system."

Boyes Rees specified a facade solution from Technal that featured high performance aluminium curtain walling. Technal and Boyes Rees Architects worked closely with specialist fabricator, Glassolutions Installation, to develop and implement the specification for the curtain walling. A slim profile GEODE-MX Visible Grid system was produced to meet the design requirements of maximising natural light and retaining the LOB building's character.

The Technal curtain walling specified was polyester powder coated (bronze externally and white internally) and glazed in clear low E high performance solar control glass to further improve the building's energy efficiency, and was used for all of the elevations on this section. The largest glazed unit that was installed spanned 1.7 metres.

For smoke control, mechanically-actuated top hung

frameless vents were inserted into the facade. Boyes Rees also specified commercial CD doors from Technal to provide access at various points around the building. Mr McLennan explains: "We looked at a number of systems and solutions and Technal gave us the best options in terms of frames.

"Our aim was to create panels of flush glazing with a smooth frame and slim sight lines. Having used Technal's systems on other projects, we were confident that they could successfully realise our design for the glazing and cost effectively."

There are three major floors at Mount Pleasant each measuring about 10,000 sq m, while there are also two mezzanine levels in the corners and a basement. Internally, the aim of the project was not just to create more space but more light. The specification of curtain walling helped alleviate the gloom as the bronze colour of the external facade system was replaced by white finishing internally.

"Internally the original building was a mixture of cream, dark green and grey and very depressing," adds Mr McLennan. "It is now white internally to maximise the light. You can do that more easily with curtain walling rather than window sections because of how they are put together."

Continued overleaf...



Morden-based specialist, Celtic Contractors, was recruited by Como for a £2.3 million package of internal works including dryline walls, GRG feature casts, Armstrong ceiling tiles and toilet cubicles.

An original parquet floor was replaced with a screed and then a BASF system supplied by Polydeck Resins. Internally, Mount Pleasant is now a mixture of Royal Mail red, white and grey. Mr McLennan adds: "What we did was to fully strip out and refurbish the interior, which enabled Royal Mail to bring



in a delivery office from Rathbone Place. Now, all central London deliveries are co-ordinated from here.”

This span of delivery locations is reflected by place names that cover the outside of the building ranging from London locations, such as Blackfriars and Hatton Garden at second floor level, to regional cities from Derby and Exeter to Leeds on the first floor level. “We were restricted to places with six-letter names on the lower level because of the building design,” smiles Mr McLennan.

The Public Office Building (POB) sits on the corner of Farringdon Road and Rosebery Avenue and required a different glazing solution. “On the POB, because it was art deco we had to get a horizontal emphasis with a mixture of opening lights,” explains Mr McLennan.

For the glazing on this element, Boyes Rees specified windows that were manufactured by Smarts of Bristol, and also installed by Glassolutions. Externally, though the style of the windows on the LOB and POB differ, the colour scheme

Continued overleaf..

This span of delivery locations is reflected by place names that cover the outside of the building ranging from London locations, such as Blackfriars and Hatton Garden



'To cap off the scheme, in a fitting testimony in the 100-year anniversary of the start of the First World War, a memorial from Rathbone Place was also moved to Mount Pleasant, which is now a lighter, brighter centre for the Royal Mail in central London'

remains the same – bronze.

The overall value of the rationalisation project is estimated at between £40 million and £50 million. The Mount Pleasant base, which also includes a childrens' nursery and the British Postal Museum & Archive, sits on a 12 acre site and the third and final phase of the project will involve some of this site being sold off. That remains ongoing, but Rathbone Place closed in 2013 and the first two phases were complete and opened by the summer of 2014.

During the evening, the south elevation is lit with LED floodlights. To cap off the scheme, in a fitting testimony in the 100-year anniversary of the start of the First World War, a memorial from Rathbone Place was also moved to Mount Pleasant, which is now a lighter, brighter centre for the Royal Mail in central London.

Project details

Project: Mount Pleasant Mail Centre redevelopment

Location: Clerkenwell, Central London

Value: Circa £40 million

Client: Royal Mail

Concept architect: Farrells

Delivery architect: Boyes Rees

POB interiors architect: HLW

Structural engineer: Curtins

Mechanical & electrical engineer: Wallace Whittle

Quantity surveyor: RLB

Project manager: RLB

Main Contractor: Como

Drylining: Celtic Contractors

LOB Curtain walling: Technal

Window Specialist fabricator: Glassolutions

POB windows: Smarts

© Technal



An altogether different glass

Increasingly used in modern railway station design, security glass is not only an aesthetically useful material, it helps to make these busy public spaces safer. Ray Philpott reports

The UK's railway stations are visibly benefiting from significant overall investment in the network. Forlorn and unloved buildings are being restored and modernised, reinvented and even completely replaced to meet today's travel needs – and creating some striking architecture in the process.

London's Kings Cross, St Pancras and London Bridge stations, along with Reading, Manchester Victoria and

Birmingham New Street are among the high-profile symbols of this new era – with many more new and redeveloped stations in the pipeline over the next decade and beyond.

Glass features strongly in contemporary infrastructure architecture. Whether used structurally, for cladding, to provide natural light or for crowd control, it is a material prized both for its excellent, versatile functionality and visual appeal.

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However, today's station designers are having to take into account two different but equally critical safety-related issues.

Firstly, the UK is under the most sustained security alert since World War Two. Amid fears that a major terrorist attack on our soil is looking increasingly likely, the country's official international terrorist threat level was upgraded from 'substantial' to 'severe' last year.

Secondly, more people are catching trains every year, making effective crowd management, intuitive wayfinding, and easily accessible emergency escape routes an increasingly important aspect of safe station design.

There's no doubt glass enables designers and architects to create less cluttered, easier to navigate and more open and well-lit public areas in stations. This makes these busy public buildings safer for travellers by providing greater visibility on concourses, platforms and thoroughfares and deterring potential terrorist activity.

However, one potential drawback of glass is the way it behaves in an explosion, as Gary Bundy, Technical Director of Sto, a manufacturer of state-of-the-art explosion-resistant glass, explains.

"When a device is detonated in a built-up area, the majority of injuries sustained are not from the blast itself but from the debris – and particularly glass fragments – that fly around with devastating effect.

"An exploding bomb creates an instantaneous release of energy generating heat and a blast wave felt as positive pressure. The blast wave carries destructive power from the seat of the explosion and is deadly to anyone in its vicinity. In its wake though, comes negative pressure, causing debris to fly large distances with potentially catastrophic consequences."

Right choice

Clearly, increasing the safety of the building involves selecting the right glass and fixings to reduce blast debris.

Bundy says: "The Department for Transport's 2012 Security in Design of Stations (SIDOS) Guide recognises the risk of terrorism and the potential for the station infrastructure to 'include proven and effective protective security measures that will prevent, mitigate or deter attacks from terrorists.'

"Annealed (toughened) glass breaks into sharp shards which are potentially lethal, so glass has always been a focus for safety guidance. The design of doors, windows and shopfronts has been regulated for some years, but recently glass facade systems have been included in safety scrutiny."

He continues: "For station designers there are three areas of concern: the type of glass and its behaviour under blast conditions; the stability of the attachment of the glass to its fixings; and the security of the mechanism used to fix the



At Reading, architects have used security glass to create striking visual features while offering great resistance to blast damage

whole facade system to the building fabric.

“The relevant standard is ISO 16933 2007 – Glass in Building: Explosion-resistant security glazing. This is a procedure for establishing the air-blast resistance of glazing systems – remembering that most of the damage is caused by glass fragments pulled away from the building fabric by the negative force that follows an explosion.”

Smart glass at Reading

Reading station, one of busiest parts of the UK rail network, recently completed a four-year redesign and refurbishment that has delivered new platforms, a whole new entrance and a complete reworking of the passenger circulation areas.

Network Rail and Grimshaw Architects have turned a struggling 19th century station into an effective modern transport hub.

Over 1,200 sq m of StoVentec glass cladding – an explosion-resistant safety glass developed by Sto – forms the station’s highly aesthetic cladding.

Intensive test results show the security glass effectively withstands the effects of a blast. Bundy points out: “This means glass doesn’t have to be excluded from the range of materials used in public spaces at relatively high risk of attack.”

If this specialised security glass fractures, it breaks into small granules rather than the dagger-like shards created by conventional annealed (toughened) glass.

During manufacturing colour is applied to the surface of the glass, providing an attractive, enamel-like coating offering a permanent, high-quality colour finish. The glass is then bonded to a carrier board, creating a 30mm thick composite panel that can be fixed to the building’s structure with a secure stainless steel or aluminium fixing system.

Specified by Grimshaw, the glass was chosen to combine excellent aesthetic qualities with a robust, safe and easy to maintain surface that was straightforward to retrofit to Reading’s existing structure.

The visual appearance was the starting point. “It was really important to get the colour absolutely right,” says Grimshaw’s project architect Nick Hawkes. “We specified the RAL colour, which the manufacturer was able to match precisely and consistently.”

In this case, the smoky grey finish provides a contemporary, monolithic colour that runs throughout the concourse areas, ticket halls and one facade. Typically this sort of glass is used as part of a ventilated facade where the system is open jointed. However, for Reading station, a solid face was required to prevent rubbish or cigarette ends being pushed down behind the panels. The solution was to apply colour matched silicon to fill the gaps to give the solid finish required.

The mechanical fixing required by the system was simple to accommodate, as Hawkes explains: “The original structure was a mix of concrete blockwork and in situ concrete that was structurally sound.

“We wanted simply to clad over the top of it, which meant that we didn’t need to do any remedial work to the surface. The glass cladding is fixed to a metal frame which in turn is fixed to the concrete substrate. It’s a relatively easy system to work with.”

A clear vision

In the West Midlands, Birmingham New Street station is undergoing a revolutionary multi-million pound makeover that uses glass to meet modern security requirements for crowd management.

After decades as a gloomy subterranean cavern of a station, the roof is being opened to let light flood down through a gigantic 60m-wide atrium by concept architects AZPA, made from virtually clear lightweight ETFE cells.

On the concourse though, glass plays a very important role. Network Rail’s Head of Design, Carol Stitchman, says: “There’s a lot of security quality glass on the concourse level. The whole building – which includes the integrated former Pallisades Shopping Centre – is built on a perimeter of extra-strong, blast-resistant glazing. All glass has to be highly fire-resistant as the concourse and platforms are classed as ‘sub-surface’ and subject to stringent Section 12 underground station fire regulations.”

The concourse features escalators and stairs with glass balustrades leading to platforms on the level below, and clear glass balustrades serving as walls to guide people around the area.

Stitchman adds: “Fundamentally this offers better security and wayfinding. The problem with the old station’s dark and cluttered layout meant people couldn’t see each other on the platforms or concourse.

“The new security glass balustrades give people views right across the station, offering visual connectivity, but at the same time, being 1.8m high, they prevent people entering platforms without a ticket.”

In the event of an incident there are much better means of escape now. Instead of the old difficult to find and small exits/entrances, there are three large, clearly defined routes to get out of the station, each combined with new larger exits/entrances.

Stitchman adds: “People can see the exits very easily through the glass walls and observe others moving towards them. They can choose a more appropriate exit if one looks too busy, which helps prevent everyone cramming into one exit. When people have wider, longer views and can clearly see

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The redeveloped Birmingham New Street station concourse is filled with light



The use of security glass at Birmingham New Street helps to give people sweeping views through the station concourse

where they need to go, they're more comfortable, calmer and less likely to panic."

Network Rail and Atkins architects, which are responsible for the concept development of the public realm with AZPA, and the ongoing detailed design, have also used security glass to form three 'lounges' on the concourse.

When an event – such as a broken escalator – disrupts natural movement on the concourse or platforms, the lounges

can be used to hold passengers for a few minutes before they board their train.

Stitchman concludes: "Through the atrium and use of glass on the concourse itself we've created safer, light-filled, open-plan space with places to eat and shop, somewhere people will actually want to spend time before catching their trains."

In terms of station design, security glass is undoubtedly going from strength to strength.

'Clearly, increasing the safety of the building involves selecting the right glass and fixings to reduce blast debris'



The whole building is built on a perimeter of extra strong, blast-resistant glazing



People will want to spend time to eat and shop at the station

Design versus functionality

Jon Palethorpe, commercial director at Sapa Building Systems, examines the growing trend for using aluminium curtain walling systems and explains why they've become integral to contemporary architectural design

Creating beautiful and striking buildings that are also innovative and push boundaries is a constant challenge as architects strive to find new ways to achieve design excellence. Add to this the increasing importance being placed on energy efficiency and sustainability, and there is a difficult balance to be struck.

Design potential

According to the Council for Aluminium in Building (CAB), around 25 per cent of the world's aluminium is used in building and construction and its popularity as a building material continues to increase. Aluminium is incredibly versatile; unlike most other metals, it can be economically extruded into almost any shape to exact tolerances and therefore meet unique structural and aesthetic requirements, providing architects with endless design potential.

In the last ten years, some of the UK's most iconic commercial buildings and premium office spaces have been created using aluminium glazing systems, such as Sir Norman Foster's 'Gherkin' building and Renzo Piano's Shard. These buildings have paved the way for ever more complex facade solutions such as the new Co-operative Group head office building in Manchester, designed by 3D Reid, which features an intricate glazed double-skin facade made from an aluminium unitised curtain wall system.

With colour anodizing and powder-coating, aluminium also provides the broadest range of finishes when compared to other materials.

Another key benefit of aluminium glazing is that it is available in the broadest range of finishes, compared to PVCu for example, and it can be coloured with architects and designers currently favouring grey powder coated and 'terracotta' finishes.

Building benefits

There are notably just two 'types' of curtain wall systems – stick and unitised – but they are providing architects with a vast range of options. Architectural commentators suggest that facade contractors and system companies have typically focused on the delivery of low rise curtain wall projects integrated with door and window systems. These systems themselves allow for 'added' options such as solar shading or photovoltaic panels.

Yet in recent years, the use of unitised curtain walling has gained momentum and although its primary use has been in

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1 Angel Square, Manchester
HQ of the Co-operative Group

‘the use of double-skin cavity facades is now becoming popular in big commercial buildings such as the Gherkin or new Co-operative HQ in Manchester, largely driven by the need for greater energy efficiency’

Pictured: I Angel Square, Manchester; HQ of the Co-operative Group



‘statement’ building in London and other UK cities, it is now much more widely available, with various types of projects able to benefit from its prefabricated approach.

Whereas stick systems are traditionally installed on site, unitised systems are made up of completed units which are hung onto the building structure. These have a number of advantages including the speed at which they are installed, which helps keep cost down and the use of scaffolding rather than cranes. This helps alleviate any problems with sites that are difficult to access such as airports, railways or congested city centre locations. Unitised systems are also constructed off site, allowing for greater quality control and minimising risk.

Although it was pioneered in a Liverpool housing project in 1978, the use of double-skin cavity facades is now becoming popular in big commercial buildings such as the Gherkin or new Co-operative HQ in Manchester, largely driven by the

need for greater energy efficiency. This innovative type of system allows air to flow in the cavity between the two skins, creating a natural source of heating and ventilation and improving a building’s environmental credentials. In cool climates the solar gain within the cavity may be circulated to the occupied space to offset heating requirements, while in hot climates the cavity may be vented out of the building to mitigate solar gain and decrease the cooling load.

Sustainability

With the Government aiming to reduce the UK’s carbon emissions by at least 80 per cent on 1990 levels by 2050, it’s little wonder that energy efficiency and sustainability are all now serious considerations for any new building.

As a sustainable building material, aluminium is fully recyclable and renowned for its ‘cradle to cradle’ life cycle. In fact 75 per cent of all the aluminium ever produced is still in circulation and the recycling process itself only requires about 5 per cent of the energy that was consumed in the production of primary aluminium.

Facades of the future

As architects continue to balance building design with green credentials, the use of aluminium as a building material can provide many of the answers. What’s exciting is the way in which architects are exploiting its versatility, which both feeds, and is fed by, the technical innovations of the world’s leading aluminium system designers.

Pictured: Worcester Sixth Form College





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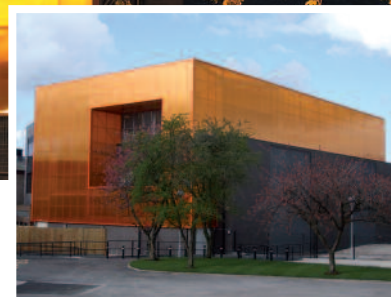
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A close-up view on polycarbonate glazing

Vicky Evans, director, Twinfix Limited, discusses the comparison of polycarbonate and glass in overhead glazing

Polycarbonate, a modern day engineering thermoplastic glazing sheet, offers many benefits over glass for use in overhead glazing.

Polycarbonate sheet, with its high strength to weight ratio, is very light in weight, but also highly resistant to shattering and breakage. This shatter resistance makes the material much safer to use than glass, especially in overhead applications such as those found in railway station canopies or factory and office roof lights.

The key benefit of using polycarbonate glazing is safety. There is very little risk of it breaking during transport, installation and in situ. It can also be installed within a panellised roof glazing system that has been classified as non-fragile to the HSE's recommended drop test ACR[M]001:2014.

Let's take a closer look at some of its key advantages.

Impact resistance

Solid polycarbonate has been used as vertical anti-vandal and security glazing for decades. Correctly fitted with a wide edge engagement it will withstand attack from a sledge hammer. Nowadays, both the solid and the multiwall products are also used for overhead glazing applications. Due to its virtually unbreakable characteristics, there is no danger of breakage during transit, installation and in situ, unlike glass. Installing polycarbonate can even result in cost savings as many contractors include an additional percentage in their quote to allow for glass breakage.

Using polycarbonate in overhead situations means no cracks, so no rain dripping in and no glass dust, fragments or shards falling onto people below.

In an effort to improve the safety of those working on roofs, the HSE recommends the use of non-fragile overhead glazing and has worked with the Advisory Committee for Roofwork to devise a suitable drop test to establish the fragility or non-fragility of roofing assemblies. CDM regulations advise that, wherever possible, risks should be designed out, so specifying non-fragile roof lights makes a great deal of sense all round and contributes to compliance with working at height regulations.

However, a note of caution here: do ensure that the products being fitted conform to the ACR test. Just using polycarbonate glazing will not comply – the complete roof light structure needs to pass the test. It's wise to ask for test certification from your supplier.



Weight

Six millimetre solid polycarbonate glazing weighs 7.2kg/m^2 , substantially less than the glass alternative – 7.5mm laminated glass weighs 15kg/m^2 , while 25mm multiwall weighs only 3.5 kg/ m^2 . The product's light weight means it is physically easier to get it onto a roof and it doesn't have to be installed with heavy steel bars as lighter aluminium glazing systems may be employed. Such systems also require little to no future maintenance.

Use of polycarbonate glazing can therefore offer a safer long-term solution for roof glazing due to reducing the strain imposed on a building's structural steelwork. This can be a major consideration in refurbishment projects.

Durability/sustainability

Unlike its glass counterpart, polycarbonate is virtually unbreakable, therefore no costly replacement of glazing is required in

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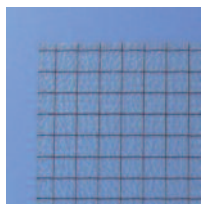
Multiwall polycarbonate panels fitted at Ealing Broadway station



Above:
Duo-pitched canopies glazed
with panels fitted with
multiwall polycarbonate –
safe glazing for any
school environment

Right:
Multiwall polycarbonate
make ideal factory roof lights

Below:
Polycarbonate glazing that
looks like traditional
Georgian wired glass



future, contributing to a lower whole life cost of the roof. It will withstand natural forces like severe wind, hail, and snow storms as well as absorbing any building movements caused by such weather. It retains its properties at both high and low temperatures, +100°C to -40 °C. This resistance to vibration damage makes it the ideal product for use where the roof also incorporates an overhead crane or in a railway station where trains are moving about underneath.

Choice of type, tint and finish

Nowadays you can choose from a wide range of different polycarbonate products, in a range of tints, depending upon your needs and where the product is going to be used.

Solid polycarbonate provides a high level of security, while the multiwall version is incredibly light in weight yet acts like double glazing. There are alternative types of polycarbonate that look like traditional Georgian wired glass, but have the many benefits of 6mm solid polycarbonate, and are proving to be great successes in heritage areas.

'Unlike its glass counterpart, polycarbonate is virtually unbreakable, therefore no costly replacement of glazing is required in future, contributing to a lower whole life cost of the roof'

Environment

We've already mentioned that polycarbonate is incredibly light in weight, and this offers environmental benefits as it requires less energy to be used during transportation and installation. If you combine multiwall glazing with a thermally broken glazing bar, you can achieve great U-values. As you can also recycle polycarbonate at the end of its long lifespan, overall it has good 'green' credentials.

Access Panels

Access panels can be fitted into some polycarbonate roof light systems, enabling regular maintenance tasks, such as gutter cleaning, to be undertaken while standing on scaffolding erected underneath the roof, rather than having to access the gutters from above, which, for safety reasons, most companies try to avoid wherever possible. This would be difficult to achieve with a glass system and would probably not be approved for use as it would prove challenging and dangerous to those trying to do it.

We believe the above demonstrates that the high-performance and sustainable benefits of polycarbonate are far superior to glass for many commercial and industrial overhead glazing applications.

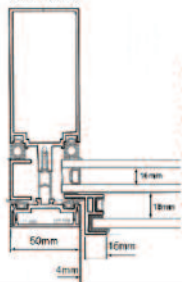
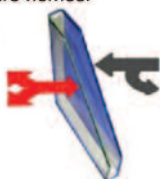


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Daylight – the new building product

Architect Christopher Sykes looks at how the ‘rediscovery’ of daylighting is radically changing architecture and is having an increasing influence on our lives. He also examines the new design and engineering solutions delivered by leading glazing engineers and contractors, such as Structura UK



Pictured: The Evelina roof of London Children's Hospital shows how refurbishment can dramatically improve performance and appearance

The historic English window tax was based on the number of windows. It was a significant social, cultural and architectural force during the 18th and 19th centuries and many domestic windows were bricked-up to avoid paying it. Jump to the mid-20th century and designers suddenly ‘discovered’ windows again and took glass in a totally opposite direction. Jump further and many buildings today, domestic to skyscraper, are virtually like fully glazed greenhouses.

Glass is one of the most interesting of building products and is closely connected with man's cultural and physical

development. It now shapes architecture, giving designers almost a fourth dimension involving interplay design between living space and natural space.

The composition of glass equally offers architects the widest aesthetic and physical benefits. Whether the glass be transparent or translucent, coloured or clear, it also needs to juxtapose perfectly with those other materials which it needs for support and which will create a successful fusion and interaction between design, technology, construction and performance.



Pictured: Used in FA's St George's Park football centre, by RedBox Design, Kalwall with integral aerogel, has an insulation U value of up to 0.28W/m²K making it almost as effective as a solid wall

Performance in practice

Daylighting through the creative use of wall or roof glazing, radically changes building envelope design and the ambience of interiors. It positively influences people, affects how they behave in their environment, changes their circadian rhythm and improves their well-being. For example, retailers sell more when customers experience natural daylight when they shop.

Schools include some of the best examples where daylight is proved to have had an extraordinary effect on behaviour, showing a marked calming influence on pupil behaviour and learning. Statistics come from the US where it was proved that learning rates were 20 per cent higher in reading and 20 per cent higher in maths in classrooms with the most natural daylight, while comparison between students with and without skylights showed 19-20 per cent faster improvement.

There are several interesting new directions which not only are changing our personal perceptions but are fundamentally changing the design and performance of buildings. A good example is the new offices for Blackpool Council designed by AHR architects. Here we see a trend where the facade itself encourages interactive entertainment. It's not just the clever use of glass but what's behind the glass which attracts. The meeting rooms are purposely located close to the perimeter so that activity within actually animates the facade. Obviously, this necessitates the clever use and positioning of the windows. This is achieved by a combination of clear full height panes mixed with what is known as fritted glass. This is a simple vertical linear design which reduces the amount of light in some spaces and provides a degree of privacy where necessary.

From Blackpool to Italy for yet another reminder about how the introduction of photovoltaic modules into the glass facade is integral to our energy strategy. One of the highlights of the 9th Energy Forum in October 2014 was the presentation by the Swiss about white photovoltaic modules for facades. With

this technology, the highest energy levels are achieved through a combination of crystalline high-performance solar cells with film treated using nanotechnology. This only filters a particular wavelength of light through the cell and reflects the visible spectrum as diffused illumination. In other words, the glass facade is no longer just a daylight introducer, it's also a fundamental, source of both power generation and solar shading.

While we know that the translucence of glass can be changed from milky opaque to clear at the flick of a switch, we are increasingly aware of digital printing on glass, facilitating branding and integral decoration which again affects the perceptions of observers in the street.

It is similar nanotechnology which gave rise to the remarkable increase in glass insulation performance – essential when architects have to tussle with the twin conflicts of maximizing daylight while saving energy. This has been achieved with materials such as low-E coated glass or aerogel, the world's lightest and best insulating solid.

Lighting the future

Of course, extreme daylighting is not all plain sailing. There have been a number of high-profile cases where the glazing has not been properly installed or where curtain-walling or atrium roofs have not been regularly maintained.

There also exist plenty of aged buildings which urgently need repair and upgrading, especially where old curtain-walls and roof lights have failed and leak air. Solving these problems and converting older buildings into contemporary showpieces can actually turn disadvantage into benefits, with improvements in both glazing performance and aesthetics.

The innovation of new technology for daylighting new buildings as well as old ones is proving to be a valuable learning process which will influence our use of glass and translucent materials for years to come.

'The innovation of new technology for daylighting new buildings as well as old ones is proving to be a valuable learning process which will influence our use of glass and translucent materials for years to come'



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Skylights break new heights

With an increased preoccupation with creating more energy-efficient buildings, skylight manufacturers have seen a heightened demand for intelligent glazing solutions. But how do the flat roof skylights fair in comparison to their window counterparts? Justin Seldis, managing director of skylight manufacturer, Sunsquare, gives his view

It's been a year of unprecedented growth for the glass industry with Palmer Market Research reporting that the domestic glazing market is entering into its largest period of growth since the 1990s. The same is true for the skylight industry. Some manufacturers have seen over a 25 per cent rise in the number of orders during the last 12 months. In part, the ability of the glass itself used within rooflights has afforded a much greater degree of flexibility for building projects.

2014 was somewhat of a landmark year for the skylight industry. After all, it saw the first skylight products verified by the BSI to meet the same air permeability, weathertightness and wind resistance that windows and doors do under BS 6375-1:2009.

The skylight industry has, up until recently, been very much one step behind traditional fenestration but the momentum for specifying intelligent glazing solutions is gathering pace.

From an industry wide perspective, the most impactful development in the last couple of years has been the wider adoption of neutral solar control glass. Traditionally and more so in south facing properties, the two hour period of the day where the sun is at its most intense, was 'controlled' by the use of tinted glass. The rest of the glazing community was embracing solar control glass, yet the skylight industry was quite literally being 'left in the dark'. Thankfully, the rooflight industry has moved on considerably and in the last couple of years has embraced neutral solar control glass, developing products that are incredibly effective at manipulating their surrounding environment.

With a completely neutral appearance, neutral solar control specifications allow designers to maximise the amount of natural daylight into a room while controlling the sun's heat. Increasingly, those specifying glass within rooflights are opting for 'super' neutral solar control glass; a range of highly selective coated glass that combines solar control with a high light transmission and Low E performance. Not only is there an exceptionally high light transmittance to the latest solar control glass products, typically 70 per cent, but the specification affords exceptional thermal insulation too.

With the development of glazing solutions that offer remarkable thermal performance, condensation has provided the skylight industry with a challenge.

Continued overleaf...





'As the glazing sector gathers pace, what is clear is that skylight manufacturing is no longer two steps behind the rest of the glazing industry. Rather, it is embracing the latest glass specifications and at the forefront of design'

Typically, most skylights are modern Insulating Glass Units (IGUs) designed to save energy and reduce household running costs. However, IGUs have low heat transfer efficiency which keeps the internal glass pane warm, while the external glass cools. This makes the units vulnerable to external condensation, which ironically shows how efficient IGUs are at retaining heat.

Not surprisingly, condensation issues have been more of a concern for manufacturers of flat roof skylights than window manufacturers since the dew has nowhere to run.

What the industry is now witnessing is the growing popularity of anti-condensation glass, which delays the onset of condensation by keeping the temperature of the external glass surface warmer. The skylight industry has embraced the on-line, low-e coated products that are applied to the external face of the skylight glass, which made their way into the market at the beginning of 2014. The results have been remarkable.

Of course, as much as the latest skylight glazing specifications are about climatic control, maintenance of the glass is equally as important. However, there seems to be a lack of clarity over the performance of so-called 'self-cleaning glass'. Now, the term 'self-cleaning' is arguably contentious irrespective of the glass product, but it is particularly misleading with regards to skylights.

Windows are progressively being coated with a substance that chemically bonds to the glass to even out its undulated surface, resulting in minimal cleaning. Skylights, however, do perform differently to windows with the same product application. After all, there is nowhere for the water to run on a flat-roof skylight and it will still need the occasional clean. That said, cleaning is much reduced and the benefit of applying a self-maintenance protective barrier is to make the skylight as low profile as possible, allowing the outside in. After all, that's what skylight manufacturers continually strive for; creating an aesthetically pleasing low profile rooflight that affords the greatest amount of light.

As the glazing sector gathers pace, what is clear is that skylight manufacturing is no longer two steps behind the rest of the glazing industry. Rather, it is embracing the latest glass specifications and at the forefront of design.

2015 will undoubtedly see significant developments in product testing and quality assurance from manufacturers looking to push the boundaries of what glass as a material has to offer.

The design options for internal glazing

The design options available for internal glazing are as wide as the design options available on the external face of a building, but there are two clear trends emerging at the moment and they sit at opposite ends of the design spectrum. IQ Glass explores these trends

Frameless internal glazing has long been used to create minimal, glass partitions and doors separating different areas of a space but in the last year a trend towards modern art-deco designs has seen steel framed systems emerging for use as internal screens and partitions, creating a more industrial, loft style glazing design.

These slim frames are generally made of steel, which helps create a more rugged industrial design. Horizontal and vertical transoms can be integrated into the opening door or partition glass facades to create any number of designs as required. The steel frames can be powder coated any RAL colour but darker colours suit this design better.

Opening doors can be integrated within these steel framed internal partitions with minimal thickening of framing surrounding the door. Door openings are commonly hinged or pivoted rather than sliding to keep all the framing inline and locks can generally be integrated into the internal door frame if needed with simple metal lever/lever handle.

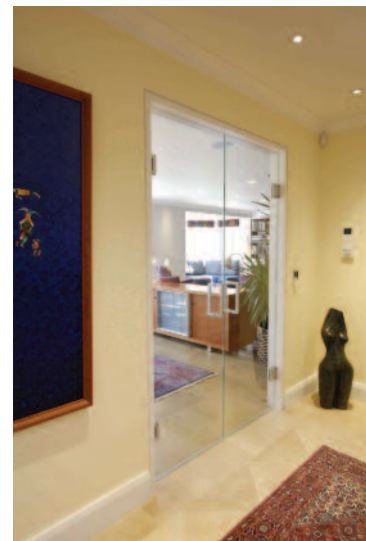
When it comes to traditional frameless internal glazing the design options available are nearly endless.

As there is normally no weather performance requirement for internal glazing and no weather sealing or water tightness required, the opening doors within a frameless internal glass screen can also be completely frameless offering a clear, minimal internal screen design.

Internal glazing can use a toughened laminated glass construction and utilise many aspects of decorative glass to create interesting glass partitions and doors. These decorative

Continued overleaf..





glass techniques can include coloured or printed interlayers as the laminate within the toughened laminated glass that can be printed with logos, patterns or photo reproductions. You can also laminate materials within a glass unit such as papers, wood, materials, to create a more tactile glass surface.

For a more simple design on the glass graduated or patterned sandblasted effects can be used and will then act as a suitable manifestation if one is required. A full sandblasted pattern or a translucent interlayer can be integrated within the glass if privacy is required through the glass.

As there are no framings involved in frameless internal glazing the maximum and minimum sizes available are as broad as the limitations of the glass itself which is 6m x 3m in a fixed pane. Where the panels meet clear silicone can be used, with hidden fixings at the head and the base holding the internal glass in place for a fully frameless appearance.

Frameless internal doors can be hinged, pivoted or sliding depending on the opening requirements. Handles will depend on the type of opening that is required but the designs available are extremely flexible. You can even use a glass handle if you want!

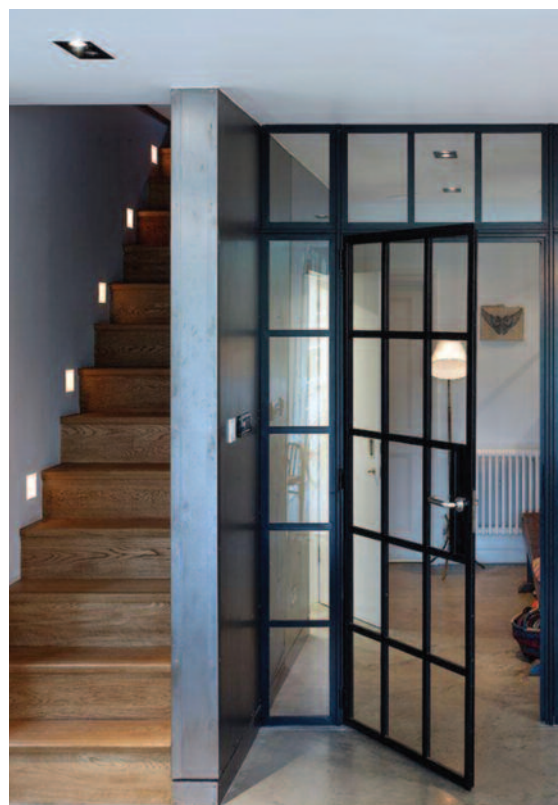
Locking can be slightly more complicated than in a framed system as there is usually no frame in which to integrate a lock but in smaller opening doors a head and base latch lock can be used.

The design options available for internal glass partitions and doors greatly reduce when an additional performance requirement is needed.

Internal fire rated screens and doors will require specialised fire rated framing and design options are limited. Where an internal partition is separating two different climates it may be recommended to use insulated glass, such as a double glazed system, in order to help with climate maintenance.

If the glazing requires a fire rating, acoustic performance or the glass is separating two different climates please consult your glazing company for design advice.

'When it comes to traditional frameless internal glazing the design options available are nearly endless'



Raising opportunities with glass

Advances in materials technology and design techniques are transforming our built landscape. The use of glass is at the forefront of this change.

Glass handling equipment supplier Hird is constantly investing in new machines capable of helping architects and construction companies create these new structures efficiently and cost-effectively.

Hird Director John Wilding said: "Our aim is to supply glass installation equipment that allows our clients – designers, construction firms and installers – to keep up with what is possible."

An example is the unique Winlet glazing robot. This Danish machine, available from Hird for hire or sale, is compact, light and easy to move.

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of the largest size and weight – plus a full range of powered access machines.

"We're a one-stop-shop for lifting, anywhere in UK," says Wilding.

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Glass walkways for Tower Bridge

Tourists visiting Tower Bridge can see a unique view of the bridge mechanism and road below – through two new glass walkway floors 42 metres about the River Thames. One of the UK's largest processor, distributor, installer and repairer of glass and glass systems GLASSOLUTIONS won the £250,000 contract to design and manufacture the (one-way) glass, which has been inserted into the floor of each of the two 11.5 metre long walkways on the Grade 1 listed building. The existing floors were removed and a steel frame was installed into which the new 80mm thick glass floor panels, comprising seven layers of glass capable of withstanding the weight of six elephants, were inserted. The glass specification was developed to accommodate major external forces such as wind loading and the potential impact should a passing vessel strike the walkways. Equally important though was consideration of internal impacts on the glass floors and how to design-in a way to easily repair any damage that results from the heavy footfall of 600,000+ visitors a year. The solution developed by GLASSOLUTIONS was to incorporate a top 'sacrificial' layer of glass into the panels

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Reynaers at Home helps Passivhaus dream come true

This spectacular home in Ireland is one of the first Passivhaus rated energy-efficient homes in the country that has exploited the use of large areas of glass. Its huge panoramic windows maximise the view to the rolling landscape without compromising on thermal performance.

Reynaers at Home's aluminium windows and doors were used, as these allow for large swathes of glass within slim frames. The CP 155-HI sliding glass doors can go up to an impressive 3m in height.

CP 155 has inherent strength, which makes it possible to offer these very large dimensions – up to 3m in height and a maximum vent weight of 400kg. Thanks to the 'high insulation' upgrade, the system can achieve superior insulation levels down to $1.07 \text{ W/m}^2\text{K}$ (Uf value). This results in a glazed element with insulation values lower than $1.0 \text{ W/m}^2\text{K}$, allowing the CP 155-HI system,



which is certified with a Minergie label, to be used in low-energy buildings. The system is available with a low threshold option that creates perfect continuity between indoor and outdoor spaces,

and improves accessibility to buildings.

Hugh Moss, head of marketing at Reynaers, says: "Minergie is a sustainability label for new and refurbished buildings with a focus on a high level of comfort in the building. Minergie standards require high-grade, air-tight building envelopes and the continuous renewal of air in the building using an energy-efficient ventilation system."

"A number of our window and door systems have achieved this Minergie label: CP 155-LS/HI, CS 77 and CS 86-HV, meaning we can offer a complete solution for thermally efficient buildings."

"Reynaers at Home is continually working to improve the U-value of our range of aluminium windows and doors to ensure that they meet the increasing demands for energy efficiency and sustainability in construction."

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Laminated glass with minute LEDs

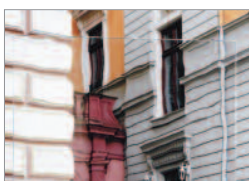


Kommerling has worked in partnership with South Korean based G-Smatt Global Co to develop G-Smatt Glass. This innovative glass based product is thought to be the world's first ever electronic building material capable of turning buildings into media screens that provide

fun, interactive 'architainment' (architectural entertainment) space and much more. Kommerling has used its expertise as a leader in the development of architectural grade sealants and adhesives to help develop this product, which also boasts low electricity consumption and has good insulation qualities, both key characteristics that are becoming increasingly important for today's architects.

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SCHOTT machine-drawn restoration glasses



The international technology group SCHOTT uses the authentic Fourcault process to manufacture its various architectural glasses for the restoration of historic buildings. This process is used to achieve an appearance that closely resembles the period in which the respective buildings were actually built. The restoration

glasses that SCHOTT offers have also received European technical certification and therefore meet the demands of monument conservationists as well as building owners and users. Furthermore, all SCHOTT restoration glasses can be processed into insulating glass, laminated glass or safety glass.

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Vetrotech Saint Gobain – fire glass specialists



Vetrotech Saint-Gobain supply a product range that not only provides total protection against fire and smoke threats – they have also been specifically designed to accommodate other multifunctional requirements such as: energy conservation, sound reduction, impact safety and physical security. With innovative research and development combined with

state-of-the-art production technologies, Vetrotech creates bespoke solutions of the highest quality, consistency and complexity. Vetrotech Saint-Gobain provides the specifier with optimal glass solutions for every fire-protection demand while perfectly blending with non-fire glass types. With over 30 years experience, you can trust Vetrotech Saint-Gobain to deliver the perfect solution.

Pure thermal efficiency



Glazing systems designer and manufacturer Senior Architectural Systems has launched Pure, a revolutionary new aluminium window system that can help specifiers achieve exceptionally low U-values and high thermal performances. The new Pure window range is the first on the market to benefit from an enhanced thermal barrier manufactured from expanded polyurethane foam (PUR). Traditionally used in cladding and insulation products, the innovative use of PUR as a thermal barrier

in windows gives the Pure system the potential to achieve U-values as low as $0.8 \text{ W/m}^2\text{K}$ and is both fully recyclable and safe to handle.

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