VELUX®
Commercial

# A GUIDE TO DAYLIGHT DESIGN WITHIN COMMERCIAL BUILDINGS USING BESPOKE STRUCTURAL GLAZING SOLUTIONS

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# 01

# INTRODUCTION

> *"The history of architecture is the history of the struggle for light."*
>
> - Le Corbusier

Commercial and industrial buildings utilised daylight as a free light source for centuries, however, over time the ways to bring light into space changed with advances in materials, technologies and construction. As industries rapidly grew, the requirements for building envelopes changed and the use of daylight for illumination was pushed aside with the emergence of electrically powered artificial lighting.

A commercially viable lightbulb patented by Edison in 1880 and the progress in energy production made electric lighting ubiquitously available by the start of the 20th century and from 1920 turning on a light switch allowed us to gain control over light. The subsequent age of cheap energy, demand for buildings and the commercial pressures of rising costs of land influenced the design of factories and public spaces. Artificial light became the prevalent light source for the new, indoor generation.

The energy crises unravelling in the 1980s forced a review of energy sources that was reflected in increases in energy costs. Commercial property owners started to concentrate more on improving the energy efficiency of buildings and daylighting came back into focus as a source of 'free energy'. Almost coincidentally various studies in the 90s observed that daylight was crucial for the wellbeing of working people (Cakir AE, 1990) and quantified the negative impact lack of daylight and resulting circadian cycles misalignments had on human performance (French et al, 1990).

Ternoy (1990) effectively proposed that the effect that lack of daylight has on the health and performance of the workforce in terms of cost can equal the cost of business' energy bills. As technology and design progressed, architects started utilising curtain glazing systems to create striking designs using large glazed areas on roofs and facades. As a result, the importance of daylight within commercial architecture had once again gained importance.

We find ourselves increasingly disconnecting from nature and gravitating toward the indoor lifestyle. The health implications of the lack of daylight and access to outdoors discussed in the 90s are exacerbated by our exposure to technology and 24-hour lifestyles. It is evident that more stringent intervention is needed to protect our environment and our natural resources.

Although we may never manage to eradicate the need for energy to illuminate and heat or cool our indoor spaces, designing daylight into the fabric of our buildings provides answers to many of the issues raised. Daylight design is now considered a key component of good commercial building design.

Structural glazing represents a flexible solution that can balance an architect's freedom in design whilst supporting a commercial building's energy and lighting strategy, as well as its overall need for performance.

# 02

# THE ROLE OF LIGHT IN ARCHITECTURE

**Light in simple terms gives us the ability to see. It stimulates our visual system to process and interpret images. Illumination in this context is a sufficient supply of light to allow us to experience space, objects, textures and colours.**

To help quantify the difference between daylight and artificial light illumination, direct sunlight delivers approximately 100,000 lux and daylight varies from 25,000 lux on a sunny day to 2,000 lux on an overcast day. Artificial light typically delivers in the range of 200-300 lux, however, 500-2000 lux is easily achievable with modern lighting. For context, areas such as hotel lobbies require a minimum of 200 lux, in offices, this rises to 500 lux and spaces where manufacturing is undertaken, or to improve visibility for health and safety, 500-2000 lux is recommended. It is clear, no matter how advanced artificial lighting has become over time, it still cannot compete with the intensity that daylight can offer.

Daylight quality is also different in comparison to artificial light sources. It is softer and more stable and provides superior colour rendering. The quality and quantity of light affect the way we carry out tasks and navigate and understand space and objects. Daylight, when managed effectively, can introduce natural, homogenous light deep into the building, whilst the frequency of daylight allows for a more truthful experience of shape and colour.

Visual qualities of daylight are utilised in architecture for the aesthetic dimensions they add to the exterior of the building or the internal space. Natural light can be amplified to harmonise or contrast exterior and interior spaces, to create shadows, manipulate the space, highlight or understate texture or colour. Designers use daylight to express emotion, explore aesthetics and evoke a mood or a sensual response.

Non-visual stimulation is an aspect of light that impacts our physiological and psychological functions. Since humans took shelter indoors, our predecessors instinctively preferred daylight over the artificial light of a fire, for example. We seek daylight because our biological responses evolved upon changes in light quality caused by weather or the changes of the seasons. Most importantly they depend on the diurnal rhythm of day and night. Light is the zeitgeber for one of the most prominent circadian cycles controlling our sleep-wake cycle (C Blume, 2019). Our bodies respond to the blue light we are exposed to during the day by lowering the production of the hormone melatonin and increasing production of serotonin, cortisol and dopamine to keep us alert and focused. In the evening, the change to warmer light signals to the body to switch the hormone production encouraging us to relax and fall asleep.

People now spend more than 90% of their time indoors. For adults, much of their waking life is spent at work. The average worker now works 36.6 h per week (OECD, 2018). The lack of daylight is magnified by our exposure to the blue light emitted by the artificial lighting and computers that surround us round the clock, causing disruptions to our finely tuned circadian rhythm. A short-term disruption can cause simple symptoms like tiredness and lack of motivation, which can be reversed.

A recurrent or permanently out-of-phase circadian cycle can pose serious consequences for our health and well-being. Our marked departure from exclusively outdoor species requires us to design healthy buildings that give us access to daylight and sunlight and the ability to reconnect with nature.

Although some of the characteristics of daylight can be mimicked by artificial light, the visual and non-visual benefits of daylight cannot be reproduced artificially. Applying daylight focused thinking is key to achieving truly human-centric building design.

# 03

## THE IMPORTANCE OF DAYLIGHT DESIGN WITHIN THE COMMERCIAL SECTOR

The design of commercial spaces is often influenced by commercial pressures and efforts to fulfil the intended function of the building as efficiently as possible. Case studies show that improved daylight design can increase individual productivity by as much as 23%, reduces Sick Building Syndrome (SBS) symptoms and absenteeism and reduces annual energy loads by 27-88%. (Herschong et al, 2002).

Designing for daylight provision in commercial spaces is the best practice most architects and designers are familiar with. Improving illumination levels, however, is only a part of the daylight design concept and the new European Standard EN 17037 extended the scope to target multiple aims in respect of daylighting and occupant comfort.

EN 17037 addresses four key areas: daylight provision, assessment of the view from windows, access to sunlight and prevention of glare. The minimum performance level is set out, but a medium and high level can be targeted, depending on specific requirements of the project. This flexibility is particularly useful in commercial design. Many daylighting strategies and aims will be identical across industries, but there are areas that have a specific impact on certain building types.

Approximately 40% of the UK workforce work in an office and spend roughly a third of their day at work. A study by Romm and Browning (1998) reported that companies in buildings where daylight was prioritised reported lower absenteeism, increased productivity and fewer mistakes. Providing a healthy environment has a positive effect on business growth. The initial investment into appropriate glazing solutions that offer improved daylighting, thermal comfort, acoustic balancing, improvement in air quality and views will see a return many times over the lifetime of the building. According to a study conducted by Imperial College in London (2017), addressing all the areas would mean a productivity improvement of around 5-8% of business turnover and initial investment into the design or an upgrade of a building has a payback period of as little as 2 years.

Natural light is a commodity that is highly valued across all commercial applications. Roof glazing can provide twice as much daylight as vertical glazing and is frequently specified for warehouses, airports and in buildings where optimal visibility in a non-homogenous landscape is essential for workplace safety and workforce efficiency. Combining roof glazing with façade glazing can help to reduce glare and provide high illumination levels, often used in sports venues and leisure facilities where excellent visibility and connection with nature are important for customer experience and retention.

Schools, nurseries and education facilities are increasingly using the combination of roof glazing and façade glazing to introduce more daylight and sunlight into classrooms and learning spaces, whilst offering a greater connection to nature. In schools that have been designed to increase natural light into the classrooms, students have shown to have higher standard test scores, noticeable less absenteeism (Hathaway et al, 1992) and interestingly pupils grew on average 2cm taller than school children with poorer access to natural light (Hathaway et al, 1992).

Provision of adequate sunlight and daylight in the healthcare sector is essential to improved recovery, as advocated by Florence Nightingale in her Notes on Nursing (1874). The Nightingale Ward model still used today is designed to afford each patient large quantities of natural light and access to views.

According to Ternoy (1999), retail sales increases of 8-12% were recorded in daylit areas, illustrating the impact ambience can have on consumer habits. The influence daylight use can have on creating a specific environment is often used to fortify brand image and enhance user experience in restaurants and hotels.

When trying to fulfil all functional criteria of a building, incorporating daylight design and recommendations of the new standard can seem a complex task. Considering daylight design at the concept stage makes it easier to design glazed openings into the fabric of the building and specify the right type, size and position of glazing systems for the building purpose so design objectives can be met to a minimum requirement.

A special note regarding COVID-19: Although we do not yet know how the recent Covid-19 crisis will influence our working culture in the long-term, its effects are unlikely to have an impact on building design and construction. A commercial building's lighting needs will still require careful consideration dependent upon the use of the space.



# 04

# MAXIMISING ENERGY EFFICIENCIES


Buildings that are mainly occupied during the day, such as offices and schools, with lighting requirements of approximately 300 lux, were shown to benefit from an 85% $CO^2$ reduction by introducing rooflights to 20% of the roof area.

The lowering of carbon emissions is pivotal to the protection of our planet. With around 45% of greenhouse gas emissions generated from buildings, the construction industry is in the spotlight to focus its efforts to create strategies to improve building energy efficiency. Part L of the Building Regulations addresses Government efforts to the delivery of nearly zero energy buildings (nZEB) across the UK and aims for fuel and power conservation by setting out allowable parameters for energy performance. Whole-building assessment methods like the Simplified Building Energy Model (SBEM) and Standard Assessment Procedure (SAP) can be used to approximate the energy performance of a building.

Large glass structures have often been criticised as leading to excessive energy use compared to more traditional smaller glazed openings. With the advances in design and technology, this is no longer the case. Balancing the airtight and thermally efficient building envelop with the right area of glazed openings of the correct specification and design can lower electrical use and improve thermal efficiency. A holistic approach to design where the strategy is a dynamic symbiosis among all parts and with the surrounding environment is supported by whole-building assessment methods that can aid in predicting the energy efficiency and running cost of the building.

Modelling proved the use of daylight and modern electrical installations, provided with systems for building automation (BMS) can lead to a reduction of electricity consumption for lighting purposes by up to 80%, and in terms of the total consumption of electricity and heat, can bring savings of 30% and more.

[Guidelines for more realistic daylight exterior conditions in energy-conscious designs Athens (2000)]. Where building automation is not available, the figures are expected to be lowered by approximately 10% in each example, however, still posing a significant improvement.

Research by De Montford University has shown a correlation between electricity use, thermal efficiency, $CO^2$ emissions and running costs. Buildings that are mainly occupied during the day, such as offices and schools, with lighting requirements of approximately 300 lux, were shown to benefit from an 85% $CO^2$ reduction by introducing rooflights to 20% of the roof area. In commercial spaces occupied 24 hours, such as hotels and warehouses, with no night-time benefit the overall saving will be lower but will still be a positive value in the majority of cases.

The advances in glazing materials offer valuable options when considering the thermal efficiency of a building. As with light, the geographical location, building orientation and the opening position can be used to improve thermal performance by controlling the amount of solar energy entering the building (g Value). Insulating qualities of the glazing are indicated by their U-value and can be attributed to the entire glazing systems or to a single pane to indicate the measure of thermal transmittance. Advanced treatments available for glazing materials afford a greater level of solar control, for example by specifying the level of reflectivity and diffusion or by reducing emissivity (low-e) that can influence the amount of solar heat entering or leaving the building. Modern glazing offers many options in terms of thermal transmittance and offers a variety of options to control the impact of solar heat on cooling or heating to best suit the function of the building.

The commercial sector is showing more tangible moral, social and environmental responsibility resulting in voluntary building standards compliance that often exceeds statutory requirements. Standards created by BREEAM that achieve a high level of thermal comfort by controlling solar gain requiring minimal additional energy, have already been successfully implemented and exceeded in schools, leisure facilities and hospitals. The under-construction 310 N Sangamon in Chicago, with 268,000 square feet of office and 7,800 square feet of retail space, is the largest building implementing daylighting and solar energy control to target reduced reduction in heating energy and cooling energy of 86% and 46% respectively. Designing for commercial buildings to make the most of natural light through façade, roof and structural glazing will no doubt play a big role in delivering energy-efficient commercial buildings.

# 05

# ROOFLIGHTS, SKYLIGHTS AND FAÇADE GLAZING

The size of modern commercial structures and requirements for multi-use commercial buildings, require a glazing area proportionate to the floor area of the building to achieve the various daylight design objectives outlined in previous sections.

## FAÇADE GLAZING IN DAYLIGHT DESIGN

Often shopfronts and curtain walls are specified to bring a better level of natural light into a building than a standard window and afford greater design flexibility. They are also ideal for improving daylight illumination and create a feeling of light and space by blurring the divide between indoors and outdoors. These qualities are often employed in retail spaces to create an open and welcoming atmosphere or achieve a specific look.

Most standard curtain walls are created by using a sequence of frames with interlocking mullions and transoms that are fixed to the existing structure or an intermediate supporting structure by gaskets or other fixing methods. This gives the designer the freedom to create a large glazed area and introduce daylight into difficult indoor spaces that traditional glazing solutions could not achieve. Façade glazing offers occupants a wall-to-wall view of the outside space, limited by the sightlines and/or fixings.

Shopfronts and curtain walls are often specified for their aesthetic appeal. Both glazing solutions can have a striking impact on the external appearance of the building.

## ROOFLIGHTS AND SKYLIGHTS FOR DAYLIGHT DESIGN

Roof glazing, such as rooflights and skylights, are an exceptionally effective tool for daylight design, capable of delivering a large amount of natural light deep into space below. Although the view roof glazing systems offer is not vas varied, the connection with nature can be maintained through a view of the skies.

Roof glazing systems are predominantly modular in design. Single units interlock to create a holistic roofing system with ventilation and shading already manufactured into the units. The width of each unit in the run can vary to give greater flexibility in terms of a shape of the building and the height of the run can also vary to fit in with sloped roofing designs. The almost unrestricted length and shape of the runs make the system suited to a variety of commercial buildings where roof space is at a premium and pyramidal-, ridge or dome-shaped glazing can be applied to maximise the amount of natural light filtering through. Rooflights with specific fragility ratings can be specified for commercial spaces where daylight is required and where roof access is necessary for maintenance or light foot traffic.

Along with daylight design recommendations, the function of the building, the age of the structure and budget are just some of the considerations for the specification of the most adequate fitting glazing solution for the purpose of the design. Both the façade and roof glazing solutions share certain characteristics. Neither is a structural system, which presents limitations in terms of size of each glazing pane. As the systems transfer dead and live loads back to the supporting structure, the structure of the building will be a constraint on the overall size of the glazed area and on the use in certain applications, such as refurbishments.

Great thermal efficiency can be achieved and both rooflights and skylights are ideal for application in new buildings, where the designers can factor in the shape and size of the opening at the conception stage. The levels of prefabrication or even complete prefabrication of glazing and glazing systems are ideal for construction convenience and speed and carry a relatively low cost.

# 06

## STRUCTURAL GLAZING – WHAT IS IT?

Structural glazing systems are streamlined systems that are fixed and installed using various methods giving the appearance of being part of the fabric of the building. The systems allow commercial buildings to have windows as walls and roofs, and walls and roofs as windows yet hold structural elements together to create a strong and secure building envelope. The level of design customisation can provide the exterior of the building with a more homogenous finish that minimises visual interruption to the façade or the roof. The flexibility of structural glazing is principal to achieving the striking look often sought to stamp a brand identity onto commercial buildings.

Conversely, structural glazing can be used to connect the building with the surrounding outdoors and reflect the location, cultural setting or convey a message. This maximises the impact of the surrounding setting on the occupant and is effective at airports and rail terminals and hotel complexes.

The interior can be equally structured to minimise visual obstructions. This can be helpful to create a feeling of openness and space in the building and shape a feeling of a community to improve social interaction, encourage dialogue and catalyse ideas exchanged in offices or in schools.

The clear view of landscapes or skies invites the outdoors into commercial buildings and reinforces the connection of occupants with nature and supports their circadian rhythms to help them work or relax or sleep at the right time. Much improved transparency means that structural glazing systems support greater light transmittance and provide bright and attractive work or learning spaces, aiding efficiency and stimulating the cognitive function of building users.

The flexibility of structural glazing offers an ever-expanding array of opportunities for designers and architects and innovative architectural design. Various options available provide the flexibility to specify a system that fits best with the desired design and performance.

# 07

# STRUCTURAL GLAZING – MORE THAN ENHANCING LIGHTING

The advantages of structural glazing do not simply lie in maximising available daylight. A major contributing factor to the increasing use of structural glazing in modern architecture is its loadbearing capacity. It is important in the conception stage to use a holistic approach and consider structural glazing as part of the fabric of the building. With careful design, the loadbearing capacity of a system could, for instance, be used to minimise the use of steel structures that would otherwise be required to support a glazing solution.

As with standard rooflights, skylights and façade glazing, qualifying criteria must be taken into consideration, although the installation of structural glazing is not as predetermined by the opening available to the same degree. The size or span of each glazing unit can be significantly larger, depending on the rafter depth used and fragility rating required for the design. This affords the designer a better ability to create larger unsupported shapes with fewer sightlines and better light transmission. The use across commercial buildings means the daylight quality is further improved for the building users and there are fewer obstructions to the view of the outside. This makes the connection with nature more realistic.

The choice of glazing material will be guided by the functionality of the building and the design specification. Various materials have different fragility classifications. Guidelines issued by NARM set out the fragility tests; CWCT TN66/67 for glass and ACR [M] 001-2019 for polycarbonate and will determine the maximum size of the glazing pane, whether glass or polycarbonate, to support the intended roof function.

## THE CLASSIFICATIONS OF NON-FRAGILITY FOR ROOFS ARE AS FOLLOWS:

### CLASS 0 ROOFLIGHTS

are effectively walk-on solutions

### CLASS 1 ROOFLIGHTS

allow walk-on for maintenance purposes only with full safety kit to be worn

### CLASS 2 ROOFLIGHTS

are not designed to be walked on, however, they are able to take impact in the event of maintenance personnel falling upon them – in this case the outer toughened pane of the glazed unit may break but the inner laminated pane is designed to prevent a fall for 30 minutes.

### CLASS 3 ROOFLIGHTS

are under no circumstances to be walked upon. These solutions should also have a barrier around them or be on an upstand sufficiently high enough to ensure they cannot be walked or fallen upon.

## IN THE CASE OF POLYCARBONATE GLAZING:

The Class B Non-Fragile to ACR[M]001:2019 Test for Non-Fragility of Large Element Roofing Assemblies should also be used.

If roof access is not a required, then fragility classifications will not be a factor limiting the choice of the glazing material or the pane size. On the opposite end of the scale, if roof access for frequent foot traffic is integral to the function of the building, fragility and safety requirements may shape the final design. For example, as thermoplastics and thermosets do not achieve the desired fragility rating, glass will be specified. Safety should always be at the forefront of specification and is a small price to pay for the limitless design possibilities the various glazing options can offer for the external visual appeal of the commercial structure.

Vitally, various industries can have specific demands for temperature control and lighting levels. The ability to specify various glazing options and finishes, or any combination, means the best glazing system can be designed to fit the commercial function and offer optimum performance and lighting for the building users' needs.

# 08

## BESPOKE STRUCTURAL GLAZING – THE IMAGINATION KNOWS NO BOUNDS

Bespoke structural glazing systems give architects the ability to choose the ideal span, size and the shape of the opening. In terms of the building envelope, the location of the opening is flexible, and the glazing can be customised to interface with the desired surface curvature or a roof pitch. By eliminating the need to factor in the glazing solution at the conception stage, the designer is presented with freedom to remain faithful to their original concept and vision.

A bespoke approach to structural façade glazing changes the sheet of glazing that envelops the building to open up exciting design possibilities. Curved or radiused external glazing or even multiple curvatures can be deployed and non-rectangular shapes and more 'irregular' shapes can be used for multifaceted façades. The attention-commanding look adds dimension to the building and can be complemented using light and light reflection.

The appearance can determine the identity to the building, visually connect it to its function or plainly iconise it to add commercial value to the estate and reinforce a brand image. The building type will impact the choice of glazing material, for instance, polycarbonate offers more flexibility in terms of shaping, but glass has a longer life span. Sound attenuation, fragility rating, illumination levels and thermal efficiency are just some of the qualities that will differ across the glazing materials. Appropriate glazing material or combination of materials can be tailored to fulfil the requirements for design function and appearance.

The ability to use various shapes expands the way daylight can be used internally for asymmetrical light distribution that increases visual comfort. In roof applications, asymmetrical light can help with the transition from light to dark and softening of shadows and contributes to a better experience at a large stadium or in theatres and museums. The freedom to create non-standard shapes of unusual sizes results in glazed roofs shaped to fit the message of the design and function of the building. The far-reaching light used in atriums and central spaces or walkways of commercial spaces can create a feeling of synergy and connection between the occupants and nature.

In refurbishment projects, the building structure requirements are often the overriding factor for the selection of glazing. Where a rigid set of building parameters may limit the glazing options, bespoke structural glazing grants more design freedom and is often more economical than installing standard glazing that may require additional structural support. Museums, galleries and public spaces in beautiful period buildings often require glazing upgrades to provide a better thermal environment and illumination for the occupants and stable, very particular climates for their collections. The flexibility of structural glazing means that the right design and correctly specified glazing type can deliver the scope of the functionality whilst retaining the desired period style criteria and complying with conservation criteria.

# 09

## WORKING ALONGSIDE EXPERIENCE

The near-unlimited freedom bespoke structural glazing can offer gives architects and specifiers the freedom to design glazing to fit their imaginations and briefs in ways other solutions may limit. It may not be clear in the concept stage, however, if the designer's vision is achievable and so consulting a glazing specialist at this stage eliminates the risk of the design not being possible, avoiding potentially costly delays or as the worst-case a design not being realised. At early consultation, a specialist can review the original concept and the criteria and help to plan in detail the most efficient way to deliver the solution.

Apart from targeting the visual aspect of the design, the type and quality of light required to support the building function must be considered. It is important to factor in any special requirements on illumination levels, UV radiation, light reflection and colour rendering, privacy and importantly the thermal comfort of buildings users. The relationship of each of the factors must be taken into account. For example, the relationship between light transmittance and reflectivity; If privacy is required in a ground floor office of a multi-purpose warehouse and the high level of reflectivity is chosen, this will reduce the light transmittance and the amount of solar radiation into the building.

A specialist glazing consultant will be best positioned to provide calculations and computer modelling that balances all elements to deliver desired building performance level, occupant comfort and ensure compliance with relevant building regulations and standards, whilst remaining true to the architect's design.

Expertise and experience can prove pivotal to delivering the right glazing provision.

# 10

# CONCLUSION

Humans by birth are not indoor species. We physically and psychologically yearn to be connected to nature. This distinctive connection is shown in the way our body and mind rely on the rhythms and changes in the outside world affected by daylight. Disconnection from the outdoor space, lack of fresh air and daylight disrupts our natural cycle of sleep and alertness. It is possible to ignore this but not without consequences to our health and mental wellbeing. From a commercial perspective to have a workforce lacking in motivation, struggling with productivity and frequent health-related absences is a burden both to finances and to the growth of the business.

The increased awareness of how finite our natural fuel resources are is a phenomenon that is driving the rise in energy prices. Daylight is free energy. It makes commercial sense to build spaces where the use of daylight can improve energy usage. The investment in energy efficiency also makes a commercial building more environmentally resilient and future proof.

The minimum standard for the energy efficiency and daylight provision of commercial buildings is clearly set by UK Legislation and European Standards. Architects, designers and the business community are collaborating across industries and striving to deliver genuinely innovative commercial building designs that exceed the minimum standards for compliance. There is an agreement that we need to do the ethical thing; create vibrant spaces for occupant health, productivity and comfort and deliver sustainable design for environment protection. The economic impact of daylight design spans beyond a singular commercial building and will no doubt be the key in the uncertain future.

The customisation levels provided by bespoke structural glazing give the designer carte blanche to achieve their vision no matter how unusual or complex it may be. The flexibility bespoke structural glazing provides means that daylight design can be included in considerations before the architectural concept is defined, giving complete freedom to create and innovate. With the right support, there are no boundaries to imagination.

Our Daylight by Design Consult Service helps to build required glazing into the architectural proposition. By getting involved at the earliest stage of the design and consulting on all the variables, the designer has the right support to bring their concept to life, no matter how complex, large or intricate it may be.

We draw on 80 years of rooflight experience and the expertise of a dedicated team of daylight specialists. We are passionate about daylight design and are very happy to consult on designs from the initial stage to assist designers and architects with their concept. We provide expert knowledge and dedicated support to ensure all bespoke segments are installed in harmony and to achieve the function required and performance to comply with building regulations and standards. We never lose sight of the initial creative idea.

Our innovative approach to design, intensive testing of solutions and industry-leading manufacturing lead times introduce certainty for specifying structural glazing. At the design stage, a timeline for manufacture, assembly, delivery and installation is supplied to facilitate meticulous and reliable construction scheduling that results in lowering the cost of your project.

Our product portfolio ranges from prefabricated modular glazing solutions incorporating natural ventilation and integrated blinds to large and complex bespoke structural daylight designs. The VELUX Commercial range gives architects, specifiers and contractors the freedom to design and specify appropriate solutions for that next new build or refurbishment project. Our combined experience and broad range of products make us the one-stop-shop for your commercial daylight design solutions.

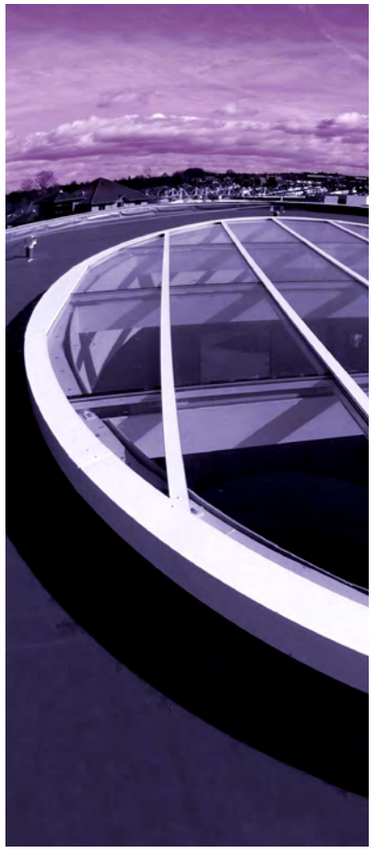
**Should you wish to discuss your next project's bespoke structural glazing requirements in greater detail, do not hesitate to contact VELUX Commercial's team of technical experts or visit our structural glazing page for more information on how we can bring your designs to life.**

# 11

# PROJECTS USING BESPOKE STRUCTURAL GLAZING

## EASTGATE ORIENTAL CENTRE, BRISTOL

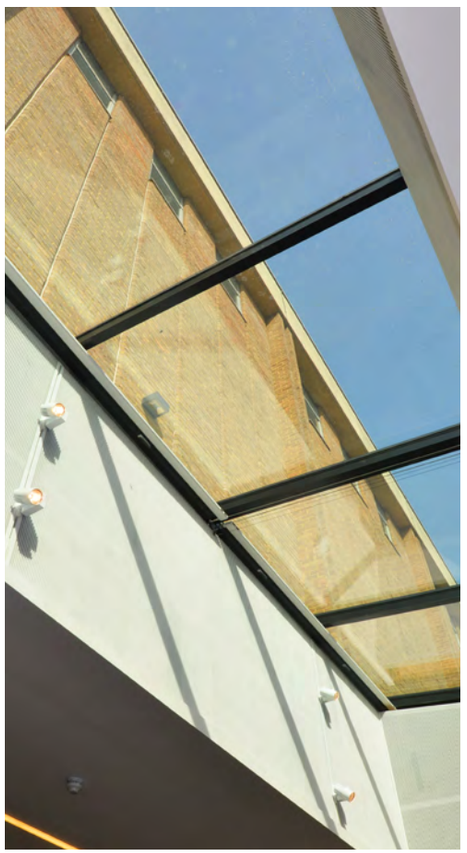
The striking elliptical oculus rooflight of the Eastgate Oriental Centre is a central focus of the building. Bespoke structural glazing, set in a shallow mono-pitch roof provides dramatic light for the staircase below, all housed in a copper drum. The solution had to fit the various design concepts required whilst overcoming technical challenges and VELUX Commercial worked very closely with the architects to fulfil their vision. The construction and the drainage route were concealed by the perimeter flashings and the rafter sizes were minimised to achieve a clean look to offer the correct lighting for the structure.



## NATIONAL ARMY MUSEUM, LONDON

The London landmark underwent a restoration with a budget of £23.5 million completely transforming the space. The brief for this project was very specific and guided by planning and conservation restraints as well as limitations of existing structures. Consultations with architects, conservation regarding the designs and products were ongoing and required a great degree of flexibility.

Several bespoke rooflights needed to be replaced with the aim to improve the thermal values to comply with Part L of Building Regulations. A feature rooflight 11x5.86m in size was installed in the atrium to bring in daylight and a louvre system controlled by a fireman switch was installed to facilitate cold smoke ventilation. The function of the building required advanced thermal control and protection from UV radiation whilst retaining high light transmittance and even light illumination with Okalux Glass fitting the functional spec perfectly. Two mono pitch rooflights were added to the Templar Study Centre.



## NATIONAL SPORTS CENTRE, ISLE OF MAN

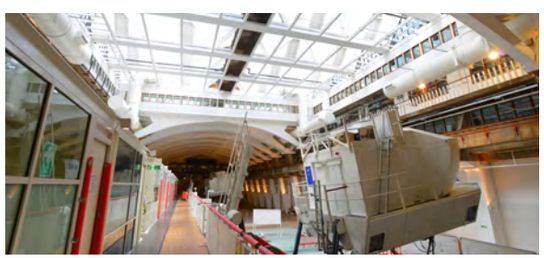
The popular centre underwent a renovation, part of which was the replacement of the deteriorated rooflight above the 50m competition swimming pool. The beautiful sloping roof with a curve in two directions in the shape of a wave presented a design challenge. A variety of practical issues had to be considered; the acoustics in the large open space, light diffusion to ensure the reflection of the water surface doesn't impede visibility in the pool, light reflection and thermal capabilities of the roof glazing for energy efficiency and of course condensation risk posed by the function of the building.

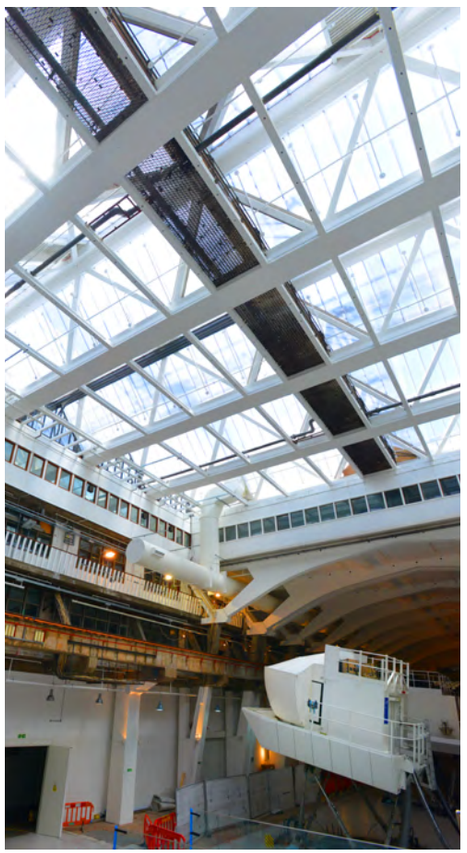
The delivered solution fulfilled the brief from a practical and aesthetic perspective and the advanced glazing products used introduced higher levels of daylight, to promote well-being and performance.

## BA SIMULATOR

The grade II listed building is home to training facilitates and 16 state of the art flight simulators. The roof was not originally part of the refurbishment, but the original Georgian wired and glass rooflights were leaking and upon calculations it became apparent they did not meet the thermal performance requirements.

VELUX Commercial was chosen to deliver and the intricate details of the refurbishment were planned and executed within the ongoing refurbishment. It was important to deliver a solution that fitted the conservation and planning details within the weight limitations of the existing structure. Heat efficiency and thermal qualities were crucial, the simulators emit high levels of heat yet require an environment that protects the equipment. VELUX Commercial designed a unique aluminium-framed glazing system, featuring the lightweight polycarbonate Lumira to fulfil the design brief and offers the optimal level of light transmission and diffusion to create a practical training environment. The careful design of the structure allowed for relatively easy installation around the existing refurbishment schedule.

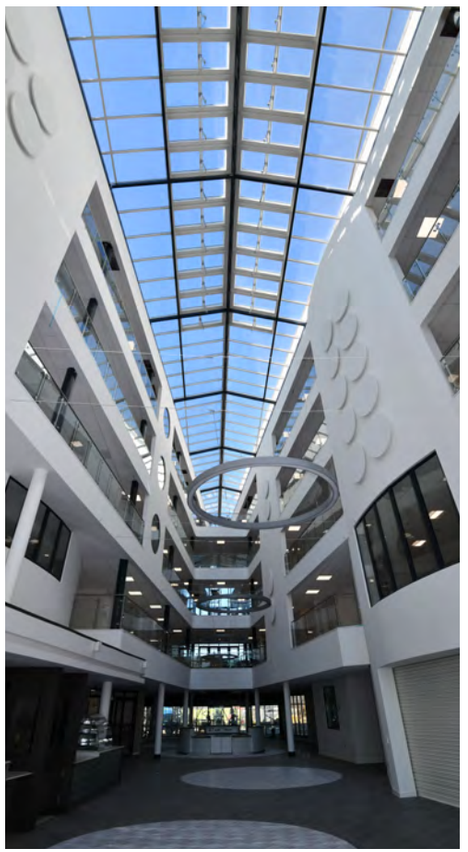




## WIXAMS RETIREMENT VILLAGE

The large purpose-built village provides 230 apartments for the over 55's seeking an alternative lifestyle. The village is built around the idea of community and social engagement and focus on daylight design was central to fulfilling the design objective. The large rooflights in various parts of the building invite daylight in and create a healthy and open space. VELUX Commercial was contracted by Galliford Try for their reliability and innovative approach to daylight design.

The atrium at the heart of the central village building benefited from a large glazing installation (12x40m) connecting gym, spa, bar and other communal facilities. The Winter Garden located in the residential part was formed as a single glazed rooflight structure flooding the five-story building with light. Smoke vents were fitted to the communal area to satisfy health and safety requirements. Lastly, a self-supported canopy was appointed over the entrance to provide a visual connection of all the glazed areas. The solution, using Polycarbonate, was not only aesthetically pleasing but helped elevate the health and well-being of Wixams Retirement Village residents. Xtralite, now part of VELUX Commercial was awarded the prestigious 'Most Outstanding Building Supplier in the UK in 2019' award.

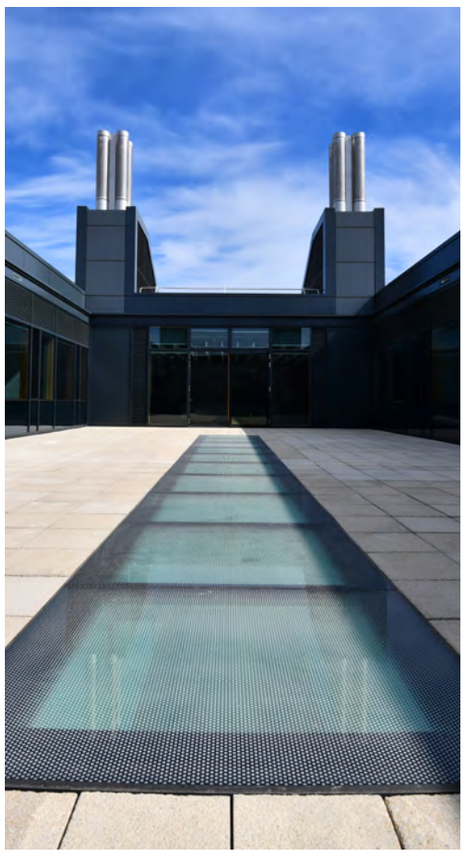


## CIVIL ENGINEERING FACULTY AT CAMBRIDGE UNIVERSITY

The world-class design of this building emphasises sustainability and futureproofing. Variety of innovative construction elements and building technologies were used throughout. VELUX Commercial was involved in the design and installation of a bespoke walk-on rooflight. The structure, made of ten equal bays, measures 12x1.5m and weighs 2800kg. To ensure health and safety compliance whilst delivering appropriate daylight provision a bespoke triple glazed rooflight was designed. The solutions is 90.5mm thick and comprises of 39mm toughened, laminated and fritted glass, a mid-leaf of 6mm solar controlled toughened glass (Guardian Sunguard) and an inner leaf made of 13.5mm thick acoustic, heat-strengthened laminate. A 16mm argon-filled cavity features in-between leaves.

VELUX Commercial recommended application of a non-slip coating, going beyond the building regulations requirements to achieve a safe, practical solution and present further design options.

The unique glazing solution provides a striking architectural feature to a venue designed to drive forward learning and innovation.



## INTU METROCENTRE GATESHEAD

First opened in 1996, the popular shopping centre in Gateshead required a major upgrade in 2016. Part of the investment was centred on maximising daylight to enhance the shopping and dining experience. The challenge was to install a large amount of replacement skylights without disruption to the trade of the shopping centre and fitting the rooflights without alterations to the existing structural steel framework. VELUX Glazing Panels were specified for the ease of installation that the prefabrication of the system affords. The five enormous glazing areas were specifically designed to suit the mall design and feature oval shapes, pitch variations, pyramids but crucially the solutions are self-supported.

The slim and low panel joints allow for a minimum visual obstruction and along with the white powder-coated finish of the internal framework fit with the existing design and create a natural feel of light and space during the day and add to the dramatic ambience in the evening. The successful installation and transformation of the design warranted further installations which were commissioned in 2018 to improve retail parts of the Metrocentre with an impressive 2-tier pyramid rooflight measuring 20x6m.

Find out more at **veluxcommercial.co.uk**

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