Natural daylight

The provision of natural daylight within the built environment can deliver genuine, positive benefits to the finished construction; benefits that can enhance the financial and environmental performance of the building in service, benefits that can improve the internal environment and make it a better, more pleasant place to be. Benefits that can make a real, measurable contribution to the Government's original target of project carbon neutrality for non-domestic buildings by 2019.

People positive

Natural daylight is our most abundant and accessible natural resource. It sustains and supports the vast majority of life on Earth and is critical to our wellbeing. On the most fundamental of levels, natural daylight is the natural state for human beings. It is the environment in which we have evolved and in which we are at our most comfortable.

It is now recognised that our bodies use light as a nutrient for metabolic processes similar to food and water, and for the production of vitamin D, essential to absorb calcium and phosphorus from our diet for healthy bones.

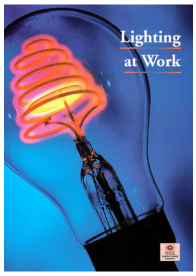
Natural daylight is associated with a whole range of positive effects on building occupants, from increased productivity and mental alertness to an improvement in general health. There is also anecdotal evidence of improved recovery times among patients in hospitals where the levels of natural daylight have been increased.

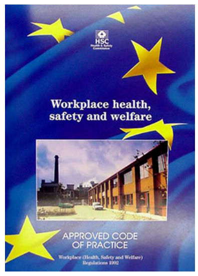
The Health and Safety Executive, in their guidance document HSG38 - Lighting at Work, recognise its importance in the comment:

"Most people prefer to work in natural daylight; therefore, it is important to make full use of it."

The Workplace (Health, Safety and Welfare) Regulations 1992 state:

"Every workplace shall have suitable and sufficient lighting which shall, so far as is reasonably practicable, be by natural light."





As a purely commercial, project cost consideration, it's completely free of charge.

All of which would point to natural daylight being the obvious principal consideration for the design of any building in which human beings are expected to spend any significant amount of time.

Daylight delivery

Rooflights are generally regarded as the most simple, cost effective means of introducing natural daylighting into the building envelope.

Positioned within the roofscape, they are generally orientated horizontally to conduct the maximum amount of light into the interior and can provide up to three times as much light as conventional windows located in walls, helping the building to more readily comply with the Building Regulations and improving the internal environment for the occupants.

Zenon rooflights manufactured from Glass Reinforced Plastic, or Glass Reinforced Polyester (GRP) due to their composition, are translucent and naturally diffusing, making more efficient use of the available natural daylight and delivering better light distribution into the building than more transparent alternatives. This reduces defined areas of excessive light and shade – or glare – within the building and improves the internal spread of the natural daylight, allowing the building owner or operator to derive the maximum use from the available natural light and reduce the dependency on energy consuming artificial lighting systems.

This is just one reason GRP is the first choice for large floor area metal buildings and is extensively used for industrial, commercial and leisure projects.

West Ham United training ground with 33% rooflights

Finding the balance

It is not always possible, or practical, to maximise the amount of natural daylight into any given building, and good daylight is not always available. This invariably means that the lighting strategy for a building design will usually include a mix of natural daylight and artificial light.

Artificial light comes a pretty poor second in terms of the effects it has on building occupants and the building itself. The Health and Safety Executive have linked it with headaches, eye strain, fatigue - and even stress.

The power required to run artificial lighting systems means an increase in energy usage, costs and carbon emissions. That contributes to a bigger carbon footprint for the overall project and threatens the project's ability to deliver reduced emissions and achieve the target of overall carbon neutrality.

In a well-insulated building, particularly in a large one, the biggest single energy saving gain nowadays can be made from saving artificial lighting energy. This single element can make a far greater contribution to energy conservation than building heat retention.

Increased use of artificial lighting systems impacts on the cost efficiency of running the building, which can have an adverse effect on the building owner's Asset Value rating.

But if an artificial lighting system must be used, the efficiency of the lighting of a building can be significantly improved by using fully automated light control systems. This maintains the required light levels with the minimum contribution from additional artificial light. Without this, the most common scenario is for all of the lights to be switched on and left on throughout the working day.

Too much of a good thing?

While considering the daylighting plan of any building, particularly relatively lightweight buildings such as those with a metal clad envelopes, designers need to remain aware of the potential for overheating caused by excessive solar gain where there is no adequate ventilation strategy, or where there are significant heat gains due to internal processes.

For any building, there is an optimum target percentage of rooflights which will deliver the optimum level of natural daylight into the building, making the optimum saving in energy usage and costs. Beyond that point, solar gain can add to the energy consumption if powered cooling systems become necessary. In high internal volume industrial buildings, the most appropriate, but uncontrolled action, to counter overheating in the building will often be to increase the ventilation by opening doors.

The ‘g-value’ is a measure of the solar heat energy that passes through a window or rooflight, most of which is directly transmitted through the material or construction in the visible light spectrum. For this reason, the solar heat transmission correlates closely with light transmission.

If properly considered at the design stage and well managed during the building’s service life, in a relatively temperate climate such as the UK, passive solar gain usually provides a benefit for most of the year, with the overheating effects only being a consideration for the hottest few weeks of the summer months.

A study by De Montfort University concluded that the optimum rooflight area for minimum energy consumption is generally in the region of 15% to 18% of the buildings floor area, for a large single storey industrial type building. If wall-lights are being considered, then the figure can be increased to 20%.

A National Association of Rooflight Manufacturers (NARM) study commissioned through Oxford Brookes University concluded that evenly distributed rooflights up to 20% of the roof area can be used without significant solar overheating.

It is vitally important to ensure that this issue is clearly understood. In the absence of any specific BS or EN standard governing the measurement of solar energy transmission through ‘plastic’ type rooflights, there is a clear need to ensure that the information provided on this issue by rooflight manufacturers, is relevant and specific. Hambleside Danelaw use full solar spectrum transmission data from physical testing by The National Physical Laboratory for all rooflight assembly data produced.

SOLAR GAIN [g-value]

Total solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.