The Building Envelope Authority

MAKE SURE YOU ARE SEEN IN THE RIGHT LIGHT

The need to produce energy-efficient buildings is, rightly, the key consideration in today's sustainability-focussed construction sector.

Saving energy reduces the carbon footprint and makes a vital contribution in the drive for carbon-neutral buildings. Equally importantly, it saves money by reducing the running costs of the operation of all buildings.

When considering large buildings, particularly in the metal industrial building sector, the traditional targets of improved thermal performance and minimised air-leakage have now reached their optimum performance levels. Put simply, they have reached the point of diminishing returns, with further increases in insulation delivering limited benefit.

Hardly surprising, then, that specifiers and clients are becoming focussed on the significant contribution that can be obtained by designing natural daylight into buildings and seeking the best rooflight solutions to deliver this free resource.

Depending on the type of lighting system installed, the cost of lighting a building can be more than ten times the cost of the heat saved by removing the rooflights. In many building designs, the cost of the lighting can be four times that of the heat losses when 'light to heat' balance has been considered. Even with contemporary low energy LED systems, this ratio can still be as high as three times. So, the daylighting plan now is becoming a principal consideration in the building envelope design and specification process.

The focus on this critical design aspect means that specifiers are now faced with a veritable haze of information regarding the choices they can make on rooflight specifications.

At this point, care is needed.

Like every other component within the metal building envelope, rooflights must perform several functions. Amongst other things:

- They must deliver good light transmission.
- This must not create excessive solar gains.
- They must deliver adequate heat retention.
- They must provide a non-fragile roof assembly.
- They must deliver a well-lit building with the right kind of light.

Not all these requirements are complementary; it is important to strike the right balance for each building design and understand that there is no ‘one size fits all’ solution.

It is equally important to understand that there are fundamental laws of physics that cannot be changed. In glazing and glass reinforced polyester (GRP) rooflight systems, most of the heat energy from the sun is transmitted directly and in the visible spectrum. Plastics such as polycarbonate have more energy transmission in the infra-red regions and beyond. This means that it is simply not possible to deliver any system with an unachievable mix of high light and low solar transmission - or ‘g-value’.

The same is true for specifications which ‘cherry pick’ only some elements of a ‘holistic package’ design in isolation. In the right building, it is sometimes possible to use smaller areas of rooflights than would normally be considered adequate, but these would be designed and intended for use in conjunction with additional offsetting renewable energy sources.

Even using rooflights that deliver exceptionally high light transmission levels, poor distribution - or inadequate areas of rooflighting - can create uneven and unsatisfactory levels of light balance within the building.

Similarly, whilst the improved thermal performance of rooflights can reduce heat loss, the inclusion of increasingly numerous ‘clear’ insulating layers or cells can be counter-productive. Each layer or cell adds an additional light reflective surface into the assembly. These cumulatively reduce the level of light transmitted into the building, costing more than the small savings in heat retention.

There is no trade-off on non-fragility however. It is about safety and saving lives, and no-one within the specification chain has the right to gamble with it. Rooflights can be made stronger by making the material thicker and more substantial, but in metal cladding systems, this can come at a cost; installation fit and weatherproof sealing becomes harder to achieve, but innovative reinforcement methods are now available delivering high impact and tear resistance in lighter thinner sheet formats.

Finally, we come to the question of which TYPE of internal illumination is best for the building. High levels of light streaming through small openings in the roof - no matter how well diffused - inevitably deliver a mixture of glare and gloom, further worsened by increased shadows created within the building by both the fixtures and fittings, and the occupants. Achieving a good ‘average’ level of daylighting within a building is very different to delivering a good, viable, uniform distribution of daylight that avoids the need for additional and localised supplementary artificial lighting.

Glare and gloom can be significantly reduced by high levels of diffusion from internal surfaces and components within a rooflight. Glass Reinforced Polyester (GRP), by its very nature, spreads daylight omni-directionally within the building and can also make a major contribution to internal illumination uniformity and comfort levels, but responsible specifiers must always recognise that diffusion alone cannot deliver the uniformity of lighting that is so often assumed or taken for granted.

So, whilst there are great savings and positive contributions to be made by incorporating rooflights into a building envelope, as with every specification issue, it is important to understand that there is the need to strike a real and meaningful balance between all of the performance characteristic options of the rooflight in order for the completed building to perform exactly as the specifier and the client intended. Getting this consideration wrong is not an option if you want to see your building in the right and best light.

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