

Using for lighting

Daylight has the potential to provide adequate illumination between the hours of 8.30am and 5.30pm for most days of the year.

roof lighting



The light bulb is a poor substitute for natural light when it comes to meeting our need for light. This is why, as of 2009, legislation in the United Kingdom demands that buildings be designed in such a way that at least 20% of wall area or 10% of roof area consists of light-transmitting elements in order to allow natural daylight in.

There are a number of factors to consider when deciding how much rooflighting should be installed in a given building, as well as the materials to be used for the lighting.

Building size

The question of whether a building should have rooflights, and if so to what percentage of the floor space they should cover, is largely determined by the size of the building.

For smaller buildings vertical glazing (windows) is generally sufficient to provide areas within six metres of the window with enough light.

For larger buildings, where there are fewer external windows relative to the building's operational floor area, rooflighting or a combination of both rooflighting and wall glazing is needed.

If well planned, rooflighting can provide exactly the amount, type and distribution of natural light required to meet any given building's requirements.

Building usage

The use of a given building will determine the required level of light, and whether this will be measured horizontally or vertically.

For manufacturing environments and office spaces, the tasks being illuminated are usually on a horizontal plane, so it is usually more appropriate to measure light levels horizontally.

For some applications (eg storage facilities and racking), the illumination of vertical surfaces is more relevant and light levels should then be analysed vertically.

In any given building the vertical illuminance levels are generally lower than the horizontal, although lower light levels are often more acceptable for tasks viewed vertically (such as storage facilities) than those viewed horizontally.

In summary

- Rooflights are a good way to introduce natural light for lighting purposes.
- When deciding on how many rooflights to install and what material to use, it is important to take into consideration various factors such as the size of the building, what it is used for, the type of lighting required (direct or diffuse), the brightness of light required and how that relates to heating, as well as the automation of artificial light sources.

How much roofighting is ideal?

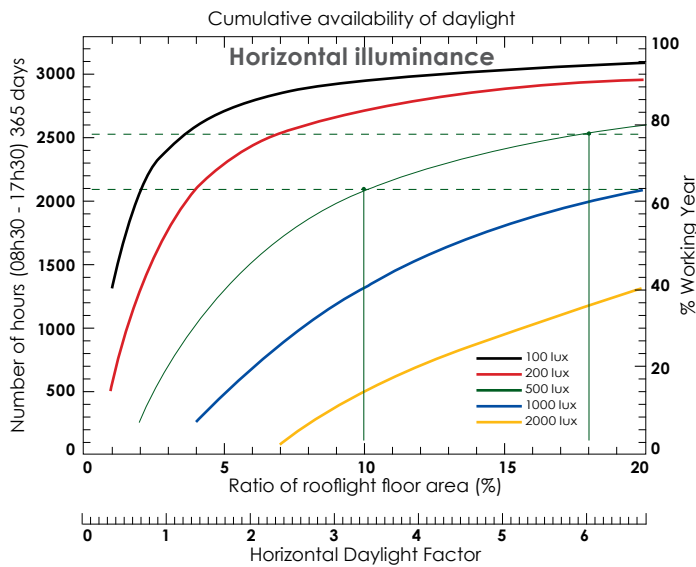


Table 1. Cumulative availability of horizontal daylight illuminance

Rooflight area ratio	Cumulative availability (% of working year)			Cumulative availability (% of working year) over rooflight area ratio of 0.10		
	200lux	500lux	1000lux	200lux	500lux	1000lux
0.10	82	63	40	-	-	-
0.15	87	73	54	5	10	14
0.18	89	77	60	7	14	20
0.20	90	79	63	8	16	32

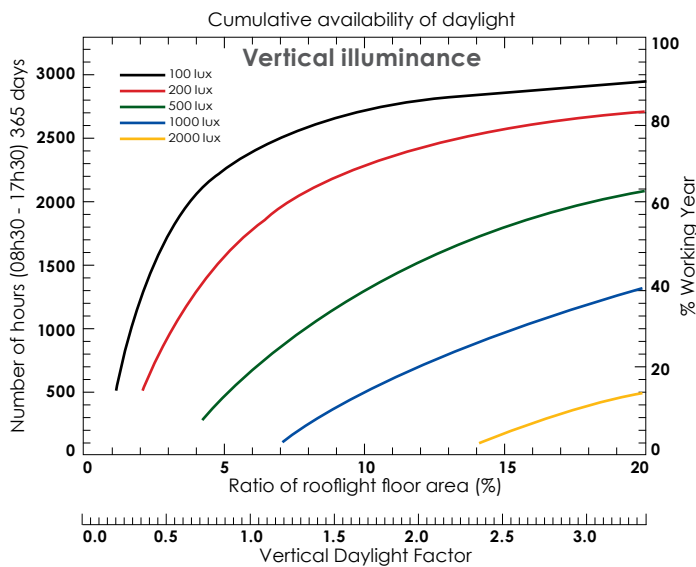


Table 2. Cumulative availability of vertical daylight illuminance

Rooflight area ratio	Cumulative availability (% of working year)			Cumulative availability (% of working year) over rooflight area ratio of 0.10		
	200lux	500lux	1000lux	200lux	500lux	1000lux
0.10	69	40	15	-	-	-
0.15	78	54	29	9	14	14
0.18	81	60	36	12	20	21
0.20	82	63	40	13	23	25

HOW TO READ THE GRAPHS

1. Select the target illuminance value, say, 500 lux. This will determine which plotted line to follow (in this case, 500 lux is represented by the green line on both graphs).

2. Select the most relevant graph to use, based on the plane of lighting that is suitable for the type of building. (Most manufacturing and office spaces will measure light on the horizontal plane, while most storage spaces and warehouses will measure it on the vertical plane.)

3. In the horizontal plane, roofighting that takes up 10% of the floor will provide illuminance of 500 lux for ~2 000 hours (60% – the figure on the right) of the year. Similarly, roofighting that takes up 18% of floor area will provide illuminance of ~2 500 hours (75%) of the year.

4. In the vertical plane, roofighting that takes up 10% of the floor area will provide vertical illuminance of 500 lux for 40% of the working year. Roofighting that takes up 18% of the floor area will provide the same illumination for 60% of the year.

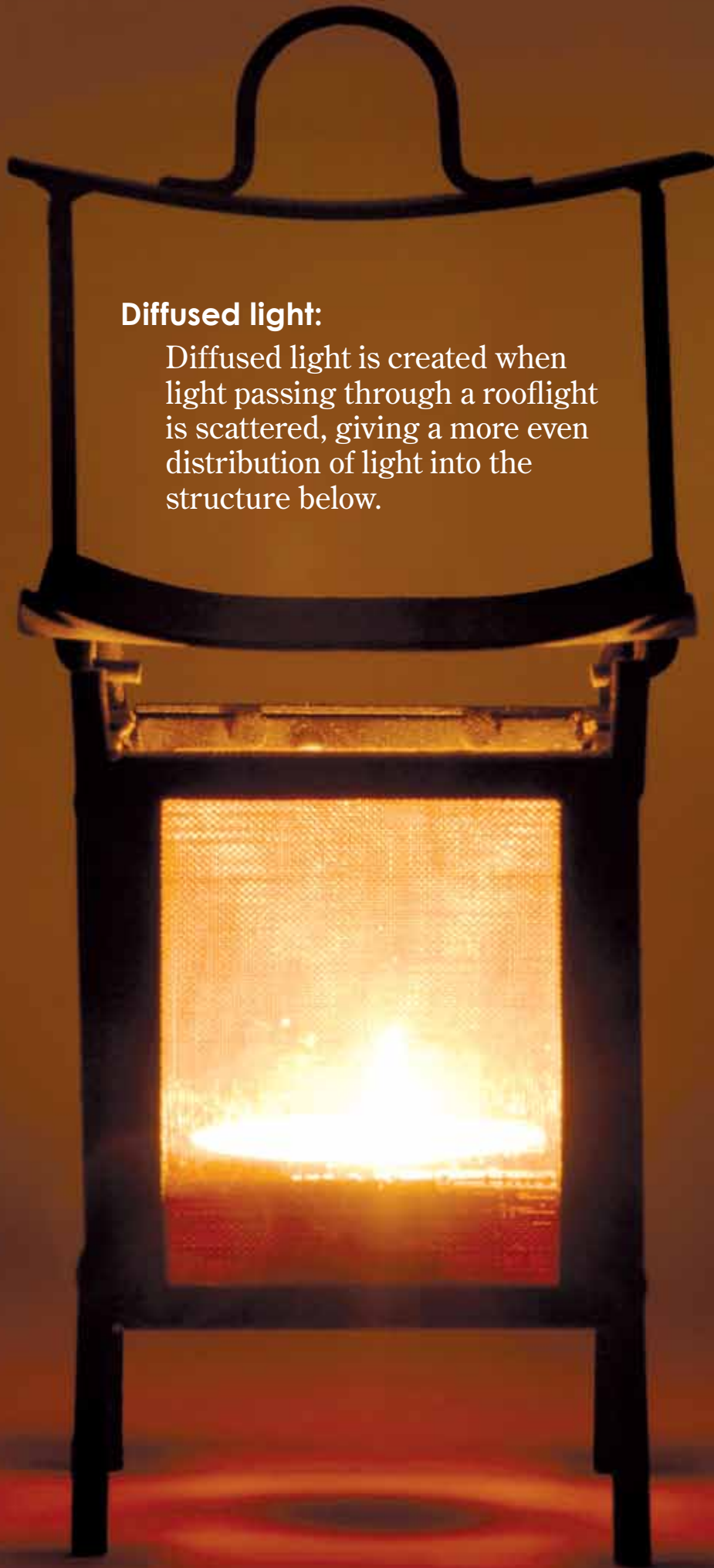
Note:

- The figures presented should be viewed as representing maximum possible values as they are predicted for empty spaces. Any possible large obstacles inside the building will effectively reduce the daylight illumination.
- An illuminance of 500 lux is generally considered on the high side for activities in warehouses. However, since the figures are based on empty spaces, there will be a degree of illuminance reduction as predicted by the arrangement and height (relative to eaves height) of items such as racking.
- It is important that designers also consider possible future uses of a building when determining rooflight area to ensure that daylight levels are sufficient for all likely uses.

diffused

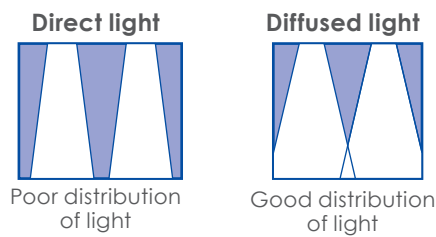
Diffused light:

Diffused light is created when light passing through a rooflight is scattered, giving a more even distribution of light into the structure below.



Type of lighting required

Rooflighting can provide two types of natural light: direct and diffused.



DIRECT LIGHT

- **What is it?** Direct light is created when light passes through a rooflight without any disruption or interference. It provides strong light on a focused area, but less general light in surrounding area.
- **When is it used?** In areas where strong light is needed on a focused area for detailed work (eg painting) or where designer wants the sky to be visible.
- **What are its drawbacks?** Direct light causes shadows and glare on sunnier days, and provides less general light in areas out of the direct beam.
- **What materials are used?** Polycarbonate, acrylic and glass in clear and most tinted options provide direct light.

DIFFUSED LIGHT

- **What is it?** Diffused light is created when light passing through a rooflight is scattered, giving a more even distribution of light into the structure below.
- **When is it used?** When the requirement is for ambient lighting over a large area with minimal shadows. Most industrial, commercial and sporting facilities prefer diffused light for these qualities.
- **What are its drawbacks?** Diffused lighting obscures the sky. Additional artificial light may be required on overcast days and in areas where detailed work is done.
- **What materials are used?** Glass-reinforced polyester (GRP) in all forms, polycarbonate, ultra high

impact (UHI) acrylic and glass in patterned and opal-tinted forms provide diffused light.

The brightness of light required

In some situations the amount of light entering the building needs to be controlled, usually to prevent overheating. Material thickness, diffusing or colour tints, and the number of skins used can all affect overall light transmission. For instance, in clear format most single-skin rooflight materials will have a light transmission of 80% to 90%. Adding a tint or an extra skin can significantly reduce this percentage.

Automation of artificial light

It is unlikely that buildings will be able to do without artificial lighting altogether. Artificial light will always be needed in certain parts of the working day and on days when it is overcast, especially in areas where light levels need to remain constant. But who decides when the lights should go on, and be switched off again? In workplaces where natural daylight levels are sometimes low and there is no lighting control, experience has proved that lights tend to get turned on in the morning and stay on all day, regardless of whether they are needed or not.

To reduce reliance on human intervention, artificial lighting can be automated to operate on a needs basis by using technology such as on/off photoelectric cells and proportional lighting controls. When deciding to automate artificial lighting, it is best to consult an artificial-lighting specialist who can put in place a system that will work in harmony with natural light to reduce energy consumption.

Standard Maintained Illuminance (Lux)	Characteristics of Activity/ Interior	Representatives Activities/ Interiors
50 - 100	Interiors used occasionally, with visual tasks confined to movement, limited perception of detail.	Corridors, Bulk Stores
150 - 200	Continuously occupied interiors, visual tasks not requiring perception or detail	Loading Bays, PlantRooms
300 - 500	Moderately difficult visual tasks, colour judgement may be required	Packing, General Offices, Engine Assembly, Retail Shops
750 - 1000	Difficult visual tasks, accurate colour judgement required.	Drawing offices, Chain Stores, General Inspection, Electronic Assembly, Supermarkets
1500 - 2000	Extremely difficult visual tasks	Precision Assembly, Fabric Inspection