

Light Control - Visible Light Transmittance (Tvis) & Openness Coefficient (Co)

Summary

- ✓ The openness coefficient is only one factor in determining the thermal and visual performance of a fabric.
- ✓ The thickness, colour, construction and coating of fabrics all have an important impact on its overall performance.
- ✓ For effective glare control whilst maintaining outside visibility, check the Visible Light Transmittance (Tvis) values and not just the openness coefficient.
- ✓ Glare is very subjective.
- ✓ A recognised standard - BS EN 14501 - is available that provides a 0 - 4 classification system to categorise shading products for their visual performance characteristics - including glare, view, night-time privacy and daylight utilisation.

1. Introduction

It is estimated we spend 90% of our time inside buildings. Studies show that for our indoor comfort and general well-being, we need to reduce glare and excessive solar gains but also retain natural daylight and a visual contact with the external environment.

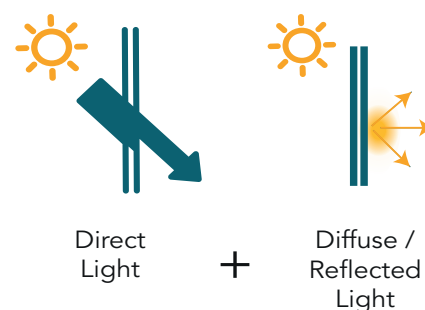
Blinds and shutters can provide us with comfortable levels of light. When shading products are extended they attenuate the amount of light entering a building and help reduce experiences of glare.

2. Visible Light Transmittance (Tvis)

Blinds and shutters visual performance is reflected in the Visible Light Transmittance (Tvis) of a shading product. The amount of light that directly transmits through the holes of a fabric and the amount of light that is diffused or reflected by a shading product affects the Visible Light Transmittance (Tvis).

The colour, thickness, construction of a shading product, and the openness of the weave and any coatings applied to a shading fabric affects the amount of direct or diffuse light that can pass through a shading product.

Validated manufacturer's data of the thermal and optical fabric properties including Tvis can be found on the ES-SDA database. Visit: www.es-so-database.com



3. Openness Coefficient (Co)

The Openness Coefficient (Co) is the ratio between the area of openings in the fabric and the total area of the fabric. It is one of the factors determining the amount of light that will pass through the fabric (others being thickness of the fabric, fabric construction and colour).

Openness coefficient is typically expressed as a percentage and indicates the view to the outside through the blind. The more holes within a fabric the clearer the view out will be. However, the amount of light diffused and reflected by the fabric also affects the view out. Selecting darker coloured fabrics that have a higher openness improves the view out. For more information on how shades of and for colour and openness affects the view out please see our Guidance Note: L-04 View Out and In.

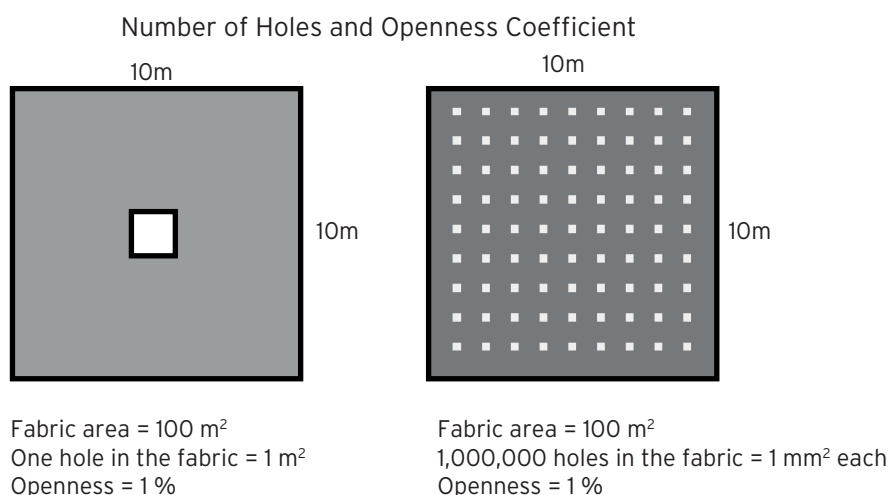
3.1. The Thickness of the Fabric and the Openness Coefficient (Co)

The thickness of the fabric will affect the amount of light that is directly transmitted through the fabric. This is because light will take longer to travel through the holes in a thicker fabric and therefore will increase the amount of the light that is absorbed by the fabric. This will also reduce the visible light transmittance (Tvis) as it will reduce the amount of direct light passing through the material.

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3.2 The Number of Holes and the Openness Coefficient (Co)

The diagrams below show that the size of the holes themselves, as well as their quantity, determine the openness coefficient.



In these two scenarios, an openness of 1% can be achieved through either one 1m² hole on a 100m² fabric or equally through 1,000,000 1mm² holes on the same size fabric.

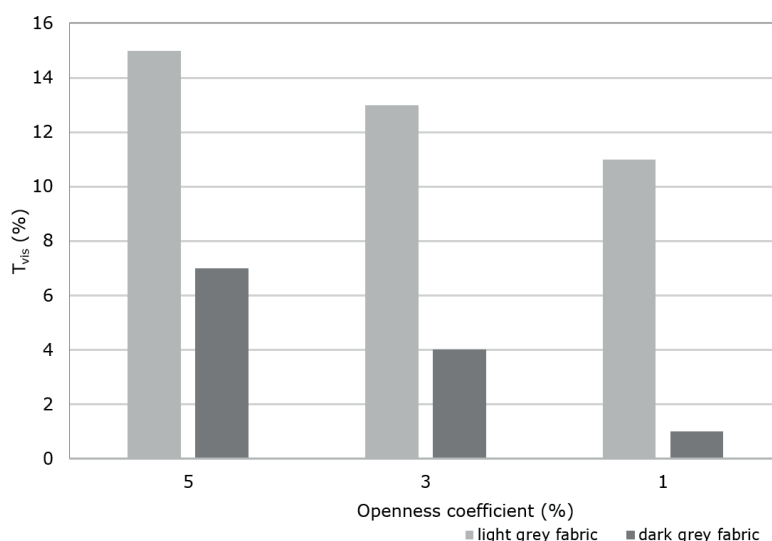
4.0 Colour, Openness Coefficient (Co) and Visible Light Transmittance (Tvis)

Openness can be easily misinterpreted and the lack of understanding of the technical data of shading products is a common reason for complaints from customers about poor specification. Changing the openness of a fabric only affects the amount of direct light entering a building where changing the colour of a shading product affects the amount of light being reflected or diffused by a shading product. Changing the colour of a product can have a greater effect on total amount of light entering a building i.e., the visible light transmittance (Tvis).

In the graph to the right we can see that whilst the openness coefficient remains the same, the different colour or shade of the fabric (in this case light grey compared to dark grey) is responsible for the significantly different amount of visible transmittance of the fabric.

Lowering the openness coefficient alone will lower the levels of visible light transmittance (Tvis) however it might not always be sufficient to achieve low enough Tvis levels to avoid glare issues. For example, if an outside daylight level is 10,000 lux and 11% of it enters the building, reducing just one factor (openness coefficient in this case) will not be enough to achieve the recommended workstation lux levels of 500 lux.

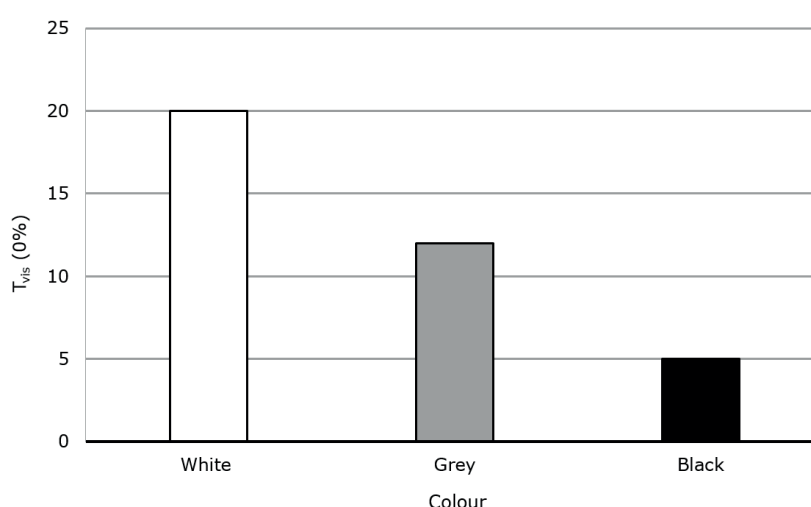
This could only be achieved by combining more than one factor - in this case by selecting the fabric with the lower openness coefficient (3% or 1%) and by selecting the darker colour (dark grey mesh fabric) which has lower Co.



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The graph below shows how the colour of the fabric (whilst keeping the openness coefficient constant, in this case 3%) affects the levels of visible light transmittance (Tvis).

The visible light transmittance of a white blind (20% Tvis) is four times higher than that of a black blind (only 5% Tvis).



The colour chosen for a shading product will also affect the thermal performance of a shading product. Darker coloured shading products absorb more heat as opposed to lighter colours that reflect more heat. When darker coloured shading products are positioned internally they are more effective at preventing glare but also heat up the internal space, which may be an issue in warmer weather. To avoid this darker coloured shading products that have a light coloured or reflective backing can be specified.

In summary the choice of colour will have an affect on glare, the temperature in the room, the view to the outside and also the comfort of the occupants.

4.0 Glare

Glare occurs when one part of the visual field is much brighter than the average brightness of the surrounding area. Where there is direct interference with vision, the condition is know as disability glare. Where vision is not directly impaired but there is discomfort, annoyance, irritability or distraction, the condition is called discomfort glare.

It is especially important to limit glare at the workplace in order to avoid errors, fatigue and accidents (EN 12464-1:2002). In 2013, HSE (Health and Safety Executive) produced a guide 'Working with Display Screen Equipment (DSE)' to help employers to comply with the Health and Safety (Display Screen Equipment) Regulations 1992. The leaflet explains what employers may need to do to protect employees from any risks associated with DSE (e.g. computers and laptops).

To see the full guide visit: <http://www.hse.gov.uk/pubns/indg36.pdf>

For more details on how to manage glare and specify shading for glare control please see Guidance Note L-02.

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5. Recommended Visible Light Transmittance (Tvis) Performance

In some cases employees prefer a lower lux level due to the orientation of computer screens, their closer distance to the window etc. Finding the right level is individual to each person and therefore it can be hard to please everyone within the same space.

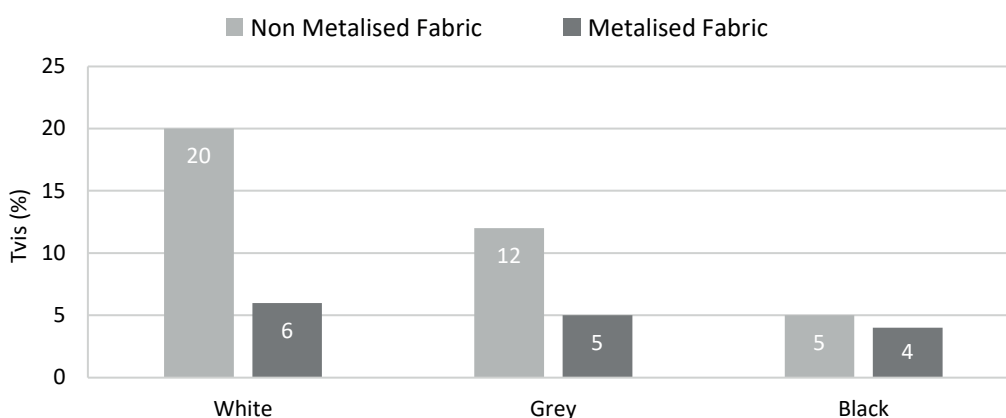
Recommended visible light transmittance (Tvis) values for an office environment are:

Tvis Levels	Type of Workplace
5%	for a highly exposed workplace
5 - 10%	for a moderately exposed workplace
10% and higher	for a north facing workplace

6. Reflective Fabrics and Tvis

Some fabrics are specially designed so the window facing side has a higher reflectance and therefore rejects more incoming solar gain and reduces the amount of light that directly travels through the fabric. These fabrics may be constructed with different coloured yarns, making one side lighter in colour than the other, or they may have a reflective coating or white backing applied to one side.

Applying a thin layer/film of metal (typically aluminium) by vacuum coating - and referred to as metallising - is one way of achieving a significantly higher reflectance on one side of the fabric. Metallisation can virtually eradicate the impact that colour has on visible light transmittance (Tvis) and reflectance so even lighter colours when metallised can lower Tvis. The graph below shows the difference in visible light transmittance (Tvis) for white, grey and black colour. In all cases the openness coefficient of the fabric is 3%.



7. BS EN 14501 Classes and Visual Performance Characteristics

Within BS EN 14501:2021 a 0 - 4 classification system is provided to categorise shading products for glare control, view, night-time privacy and daylight utilisation. 0 represents a 'Very Little Effect' and 4 represents a 'Very Good Effect'. For more details on how to categorise shading products using this standard please see Guidance Note: L-05 BS EN 14501 Classification Glare Control and ES-SO's Simplified Data Initiative.