OPENNESS COEFFICIENT AND SOLAR SHADING

SUMMARY

- ✓ The openness coefficient is only one factor in determining the thermal and optical performance of the fabric.
- ✓ The thickness, colour, construction and coating of fabrics all have an important impact on its overall performance.
- ✓ Metallisation significantly improves the fabric's performance and virtually removes the variation caused by colour and thickness.
- ✓ Glare is very subjective.
- ✓ For effective glare control whilst maintaining outside visibility, check the Visible Light Transmittance ($T_{vis)}$ values and not just the openness coefficient.
- ✓ Validated manufacturer's data of the thermal and optical fabric properties including T_{vis} can be found on the ES-SDA database.
  Visit: http://www.es-so-database.com/index.php/database

1.0 INTRODUCTION

It is estimated we spend 90% of our time inside buildings. Studies show that for our internal 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 have the ability to provide us with the desired levels of light.

2.0 OPENNESS COEFFICIENT (C_o)

The openness coefficient (C_o) 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.

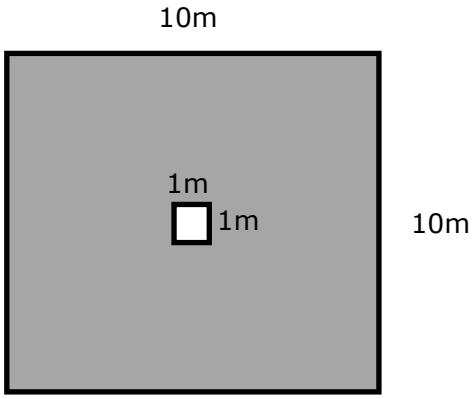
2.1. THE THICKNESS OF THE FABRIC AND C_o

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 therefore increasing the amount of the light that is absorbed by the fabric and reducing the direct visible light transmittance (T_{vis}).

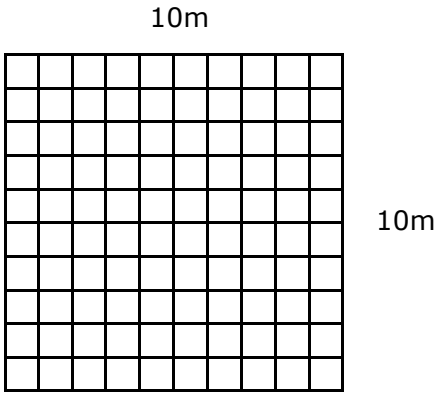
2.2 THE NUMBER OF HOLES AND C_o

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

Number of holes and openness coefficient



Fabric area = 100m^2
One hole in the fabric = 1m^2
Openness = 1%

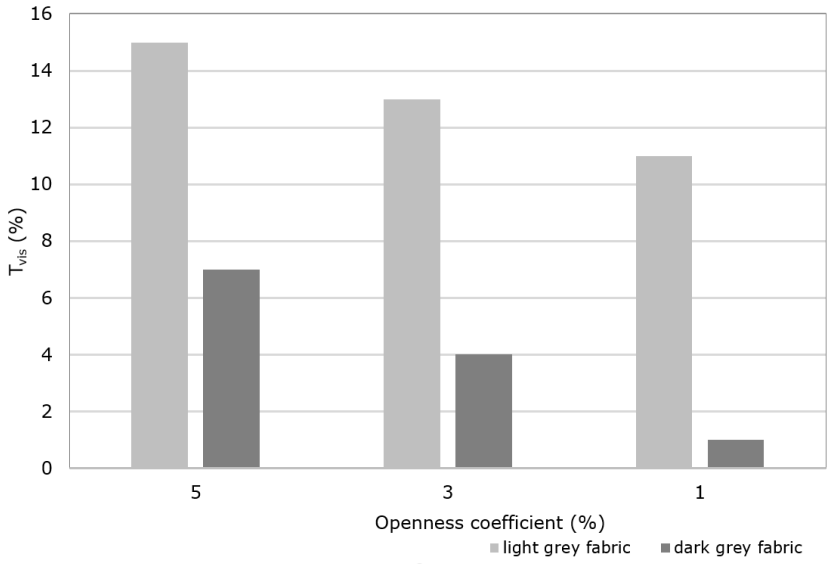


Fabric area = 100m^2
100,000 holes in the fabric = 1mm^2 each
Openness = 1%

In these two scenarios, an openness of 1% can be achieved through either one 1m^2 hole on a 100m^2 fabric or equally through 100,000 1mm^2 holes on the same size fabric. The effect of light transmission would obviously be significantly different.

2.3 THE COLOUR AND C_o

In the graph below 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.



3.0 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 any glare at the workplace in order to avoid errors, fatigue and also accidents (EN 12464-1:2002).

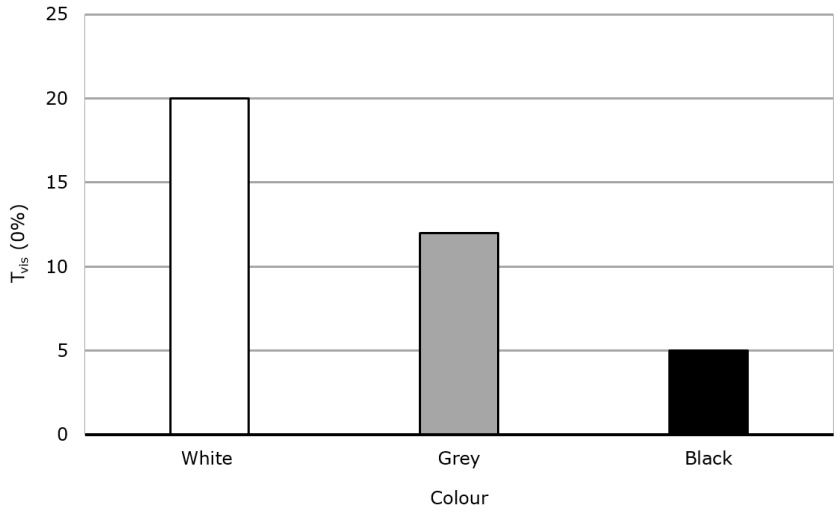
To read more visit: http://www.hse.gov.uk/pubns/priced/hsg38.pdf

Installation of blinds is one of the most effective methods of reducing glare.

In general glare is reduced by a low openness coefficient and low visible transmittance (T_{vis}).

As the openness value increases, so do the daylight levels, the through vision and the possibility of glare.

4.0 COLOUR AND T_{vis}



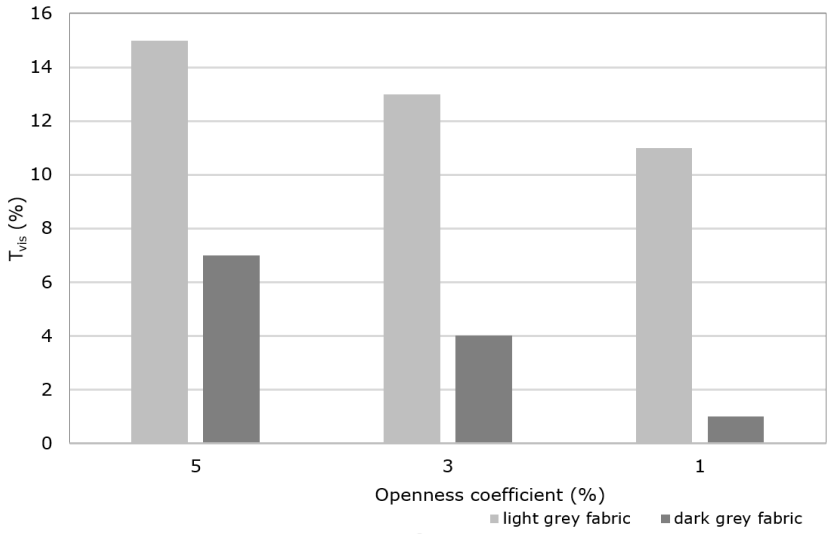
The graph above shows how the colour of the fabric (whilst keeping the openness coefficient constant, in this case 4%) affects the levels of visible transmittance (T_{vis}).

Visible transmittance of a white blind (20% T_{vis}) is four times higher than that of a black blind (only 5% T_{vis}). Therefore the choice of colour will have an affect on glare, the temperature in the room, the view to outside and also the comfort of the room occupants.

5.0 OPENNESS COEFFICIENT AND T_{vis}

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.



The graph above shows how reducing openness coefficient will lower the levels of visible transmittance (T_{vis}). Lowering openness coefficient alone however might not always be sufficient to achieve low enough T_{vis} levels. 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 C_o.

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 transmittance values for an office environment are:

T_{vis} 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

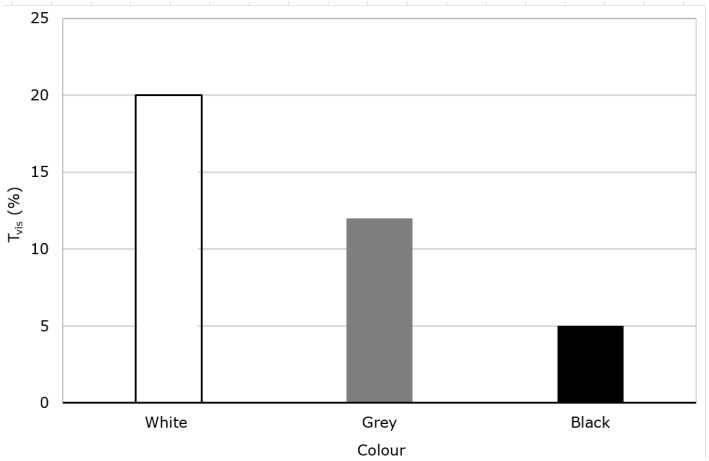
6.0 METALLISED FABRICS AND T_{vis}

Fabrics that are metallised on the window facing side can produce significantly different results to non-metallised fabrics. A thin layer/film of metal (typically aluminium) on the fabric increases the

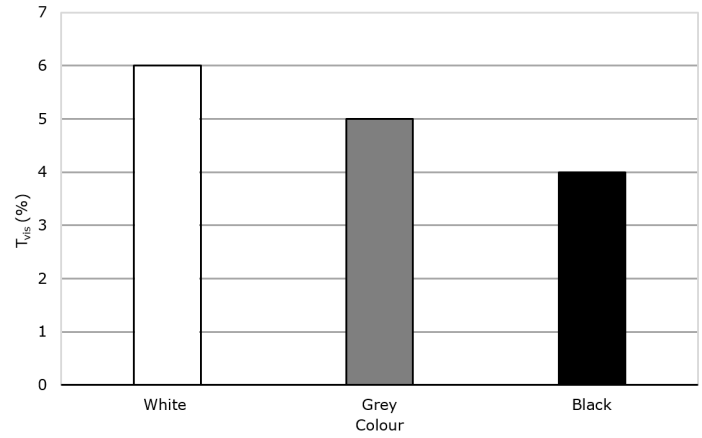
reflectance of the fabric and therefore rejects more incoming solar energy and reduces the amount of light that travels through the fabric.

Metallisation can virtually eradicate the impact that colour has on visible light transmittance and reflectance so even lighter colours when metallised can lower T_{vis}.

These two graphs show the difference in visible transmittance for white, grey and black colour. In both cases the openness coefficient of the fabric is 4%.



Non-metallised fabric



Metallised fabric