THE EFFECT OF SOLAR SHADING ON AIR-CONDITIONING REQUIREMENTS IN EXISTING BUILDINGS

SUMMARY

- ✓ When refurbishing a building priority should be given to shading over mechanical cooling as it can significantly reduce the cooling demand, saving energy and money.
- ✓ Solar shading provides glare control and a comfortable working environment.

1.0 INTRODUCTION

"Shading can result in significant reductions in CO_2 emissions and energy cost, where buildings are air-conditioned."

Building Research Establishment

This guidance note outlines the reasons and benefits for installing solar shading in existing buildings. The information is most relevant during refurbishment as most of the buildings that will be in use in 2050 have already been built.

In some refurbishment cases it may be possible to meet the cooling demand of a building without mechanical means. Passive cooling measures (those which do not require energy) can be employed such as solar shading and natural ventilation. A study by Lund University in Sweden highlighted that savings of between 23-89% in cooling energy use can be achieved from installing solar shading.

2.0 THE NEED FOR SHADING

Buildings with large facades can:

- generate overheating problems through the greenhouse effect
- contribute to an increase in cooling demand
- cause visual problems through direct and reflected glare

Solar shading can help all of these problems. This makes shading a necessity in buildings with large amounts of glass. In many cases external solar shading can counteract the overheating problems by blocking solar radiation from entering the building. However, an internal blind may also be required to provide additional glare control particularly in the winter months when solar gains should be maximised but glare is still a problem.

Air-conditioning can also deal with the problem of overheating in a building. However, it can be very expensive, it may give rise to compliance issues over energy use in the building and will also not deal with visual discomfort from glare.

Internal shading can also reduce the cooling demand of a building although larger savings will be achieved by external devices.

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3.0 AUTOMATED SHADING

A study by BRE showed that automatically controlled shading will give extra CO_2 savings compared with manual or fixed shading systems. Automated solar shading can operate on timers, light and heat sensors that ensure the shading is operating in the most energy efficient way. Automated solar shading will also mean that blinds in unoccupied rooms are being used in the correct way to achieve maximum energy savings.

4.0 REDUCTIONS IN COOLING DEMAND WITH SOLAR SHADING

The Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA) in *Guidebook 12* have analysed the difference in cost to install, run and maintain an HVAC unit for an office with and without shading.

	WITHOUT SHADING	WITH SHADING	OVERALL REDUCTIONS	
	HVAC INVESTMENT COST (£)	HVAC INVESTMENT COST (£)	REDUCTION IN HVAC INVESTMENT COST (%)	REDUCTION IN ELECTRICITY REQUIRED FOR COOLING (%)
STOCKHOLM	1,555	1,258	19%	38%
AMSTERDAM	1,520	1,251	18%	30%
MADRID	1,657	1,375	17%	40%

These calculations were carried out for a test office with a floor area of 18m^2 and a glazing percentage of 60%. For the 'without shading' case solar control glass was used whereas for the calculations with shading low-e glass was installed. In this case solar control glass was assumed to be £108/m^2 while low-e glass was assumed to be £60/m^2.

The results show that for all three locations an overall reduction in HVAC investment cost and electricity required for cooling is achieved when shading is installed. The results also show that when shading is installed on low-e glazing which is cheaper than solar control glass, improved results can still be seen.

5.0 BALANCING SAVINGS IN COOLING WITH HEATING AND LIGHTING

Specification of solar shading needs to be carefully considered to achieve overall energy savings in a building. Large energy savings in the cooling load can be made but these must be balanced with changes to heating and lighting demands. Solar shading can reduce the daylight in a building therefore increasing the electricity requirement for lighting.

In some cases solar shading can lead to increases in the heating requirement although this can be balanced by internal shading which can reduce heat loss in the winter months and dynamic solar shading systems will optimise beneficial winter solar gains.