17/07/00 Daily News

Light controlling devices

Daily News : SLIA
Housing Advisory COLUMN

Co-ordinated by Edward Arambewala

Media Consultant/SLIA

In response to several members of the public in Matara who wanted us to publish a detailed account of the ways by which light could be controlled, we re-produce a part of an article on the subject which was published in the SLIA Publication Built Environment Vol. 1 of December 98, written by Architects Sashikala Ranasinghe and Ranjith Perera. SLIA Council Member, Architect Dr. Ranjith Dayaratne edits this publication.

Light controlling devices are either integral components of apertures or attachments in buildings which help to keep direct rays of the sun away from the interior.

Moreover, they provide protection from rain and sometimes influence the pattern of air movement in the interior space. Light controlling devices and shading devices can be divided into interior and exterior types.

The fact that sunlight within a building contributes to solar heat gain, care should be taken in choosing between the interior and exterior types of shading. In this respect, exterior shading devices are more efficient when both lighting and cooling are considered as equally important.

The most common light control and shading concepts are:

- overhangs and external overhangs
- light shelves
- horizontal louvres and blinds
- vertical louvres, firns and blinds

Overhangs are used in conjunction with side lighting concepts and are often an extension of the roof plane passing the plane of the aperture. For proper sun control, an overhang must shade as much of the glazing as possible, specially during the period when the sun makes the maximum angle with the vertical. A sun path diagram in relation to the location would be the ideal guide in this respect.

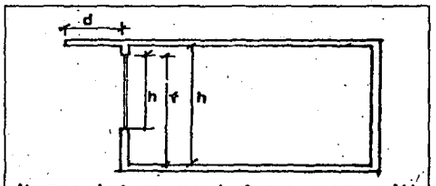
The overhang size (d) can be determined from the height of the aperture to be shaded (h) and the solar altitude (0) such that d=h/Tan 0 (see Fig. 1)

A light shelf splits the aperture in to a view light below the shelf and a clear storey light above the shelf. Placing the shelf inside or outside the building can change the characteristics of the performance considerably.

Interior light shelves provide less penetration than exterior ones under all sky conditions, excluding the effect of the sun. With direct sunlight, it shades a portion of the interior but affects the cooling load, since it does not shade the glazing.

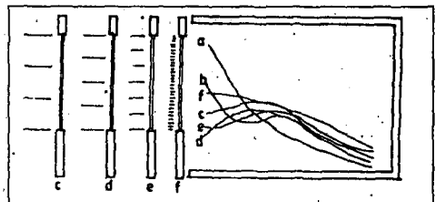
Exterior light shelves improve the penetration of daylight in to the space under all sky conditions. They act as shading devices and reduce solar gain. Sunlight reflected on a top surface penetrates into the building (see Fig. 2) horizontal louvres and blinds could function on all facades. They control direct sunlight and reduce sky glare. Externally placed louvres function better in lowering cooling loads (see Fig. 3).

With regard to the use of light controlling devices in top lighting concepts, the application would be more towards controlling the direct sunlight falling on the work surfaces than improving the efficiency of the design.



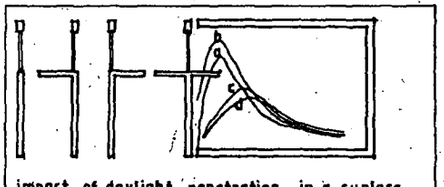
Nomenclature used for a room with an overhang

Fig 1



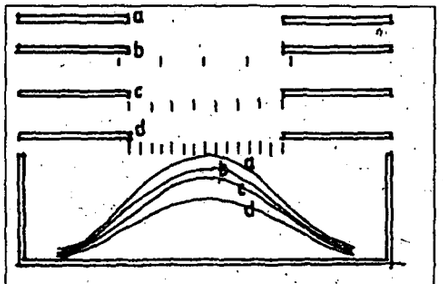
Perfomance of horizontal louvers and blinds at different D ratios.
a) D = 1:1, extended over hang (not illustrated)
b) D = 0·5:1 (Not illustrated) c) D = 0·25:1
d) D = 0·20:1 e) D = 0·17:1 f) D = 0·03:1 (blinds)

Fig 3



Impact of daylight penetration in a sunless room with various lightshelves when H=1·5:1 V= 1:1 H = ∞ :1 (solar altitude = 30° solar azimuth = 0) and D is varied as a) no light shelf b) D = 1:1 c) D=1:1 d) D = 2:1

Fig 2



Illumination variation from skylight varying louver spacing as a) no interior louvers. b) spacing = 1h. c) spacing = 2h, Spacing = 4h.

Fig 4

Adjustable parallel baffles similar to a Brise Soleil (an external sun breaking device provided in opening) can be mounted below horizontal apertures to intercept the direct rays of the sun and diffuse them. The baffles should be adjustable to match the movement of the sun during different periods of the year and should therefore be positioned in relation to the sun at which such light could be advantageously utilized through reflection of different surfaces (see Fib. 4)

path. This type of device also reduces the heat gain to about one third and thereby contributes to the efficient use of energy in buildings.

However, in all the possible solar control methods, there is still an appreciable contribution to heat gain within a building from natural lighting, due to the admittance of high frequency ultra-violet rays and the infra-red rays.

It is not appropriate to change size, position and location of the openings solely for the purpose of providing good ventilation across a room, since obtaining maximum daylight penetration is also a determining factor. Therefore, certain external features could be utilised in the building environment (e.g., providing ventilation through stack effect and landscaping modified through careful laying out of vegetation and water bodies etc.) to induce air movement and thereby causing a satisfactory thermal condition. It should therefore be clearly borne in mind that providing thermal comfort should always be considered as a part of any delighting design.

Dr. Ranjith Perera is a Senior Lecturer at the Department of Architecture at the University of Moratuwa and Archt. Sashikala Ranasinghe was an M.Sc Student at the Department in 1995/6. Presently Archt. Ranasinghe is reading for a M.Sc. Degree in Architectural Lighting at the Pennsylvania State University, USA.