a publication of

PAM PERTUBUHAN AKITEK MALAYSIA
MALAYSIAN INSTITUTE OF ARCHITECTS

SOLAR SHADING DEVICES FOR WINDOWS IN TROPICAL CLIMATES

PAM Practice Notes

December 2009
Serial No.: 1-2009

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This practice note serves to refine some of the Architects available knowledge about the effects of Solar Shading devices on heat gains into buildings in tropical climates and in particular Malaysia.

The only external source of heat going into buildings is from the sun. For low rise buildings such as terrace houses, the roof is the surface that receives the most solar radiation and therefore the most heat gain.

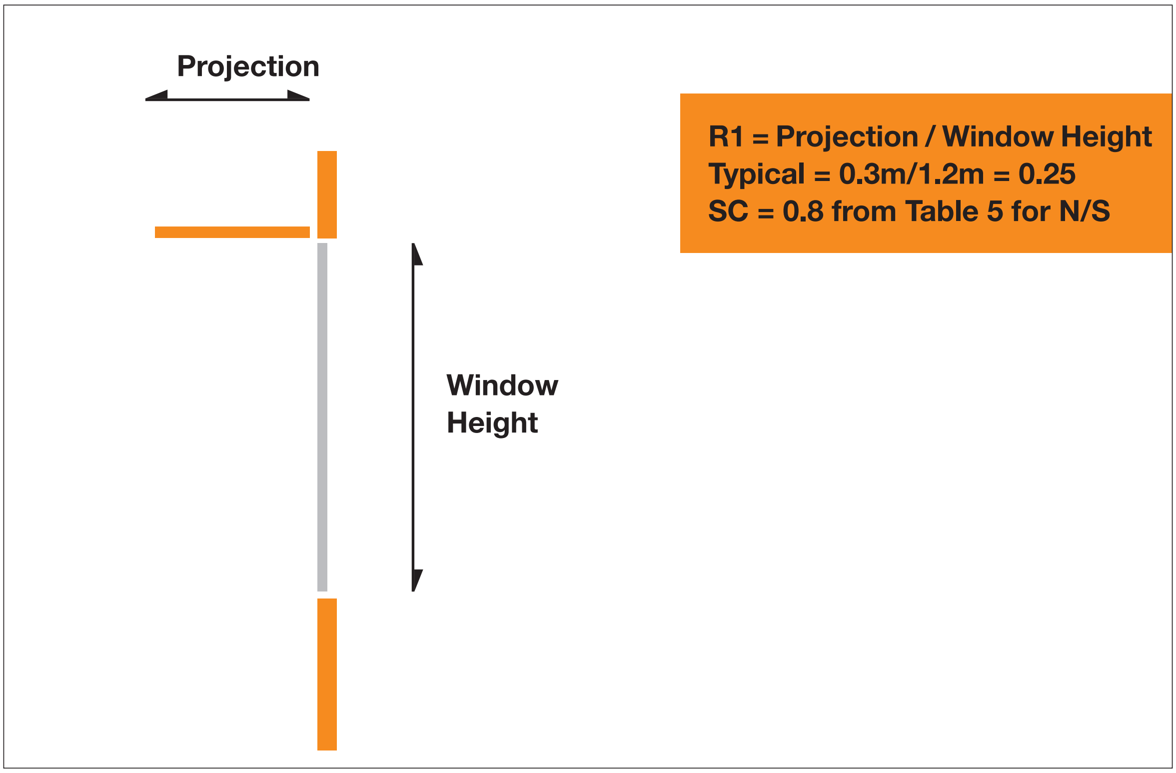
- The roof plane receives the most Solar Radiation and for the longest period through the day
- >75% of the Solar Gain by a typical Intermediate Single Storey Terraced House is through its ROOF
- >50% of the Solar Gain by a typical Intermediate Double Storey Terraced House is through its ROOF
- >40% of the Solar Gain by a typical 5 Storey Bock of Flats is through its ROOF

For high rise buildings, with the lower ratio of roof area to total fabric area, the heat gain through the walls and windows becomes the major source of heat gain. A major portion of this heat gain is from direct sunlight through the windows. Depending on the ration of window to wall area, the total heat gain from direct sunlight through windows as a total of heat gains through the building fabric can vary from 75% to 85% of total heat gain through the fabric. Reducing this direct solar gain is therefore very important in order to maintain a cooler interior. The most effective way to achieve this is through the use of window shading devices.

The question then arises of how much shading is enough and how effective are these shading devices? A fairly accurate method of estimating the effectiveness of window shading devices is provided by the **Malaysian Standard MS 1525 : 2007 Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings**.

Table 5, Table 6 and Table 7 are reproduced in graphical format to show the Shading Coefficients achievable with different shading devices. What does the SC or Shading Coefficient represent? **The shading Coefficient in effect represents the total percentage of heat gain from direct sunlight still going into the window on average through the year**. A window shading device that gives an SC of 0.8 or 80% therefore only shades out 20% of the direct sunlight, while a window shading device with a SC of 0.6 or 60% will shade out 40% of the direct sunlight throughout the year. Using the charts and tables 5 to 7, Architects can therefore very quickly estimate the effectiveness of their window shading devices.

There remains the question of how we derive R1 and R2 from the tables. This is simply the depth of projection out from the window as a ratio of the window height as shown in the diagram below for horizontal shading devices.

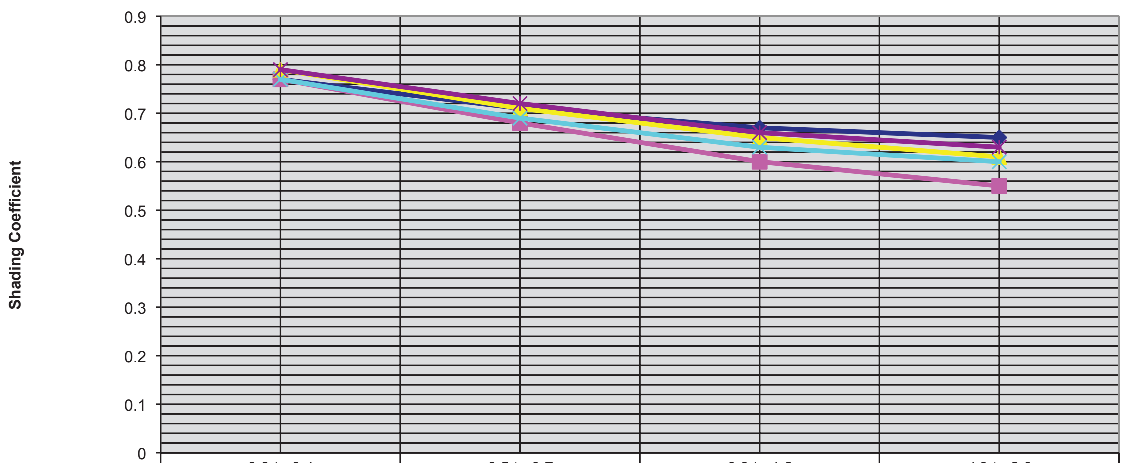


R2 applies to vertical projections and is the ratio of Projection depth to the width of the window. For egg crate shading devices both R1 and R2 will apply.

As can be seen from the tables and charts, the horizontal shading devices are more effective than vertical shading devices. However egg crate shading devices are the most effective being able to shade out almost 60% of direct sunlight.

The next question that arises is what is the effect of a combination of low SC glass and an external solar shading device? The total SC of the combination is derived by multiplying the two SC.

HORIZONTAL PROJECTION SHADING COEFFICIENTS (Table 5 of MS 1525)



	0.3 to 0.4	0.5 to 0.7	0.8 to 1.2	1.3 to 2.0
North/South	0.77	0.71	0.67	0.65
East	0.77	0.68	0.6	0.55
West	0.79	0.71	0.65	0.61
NE/SW	0.77	0.69	0.63	0.6
NW/SE	0.79	0.72	0.66	0.63

R1 (Projection / Window Height)

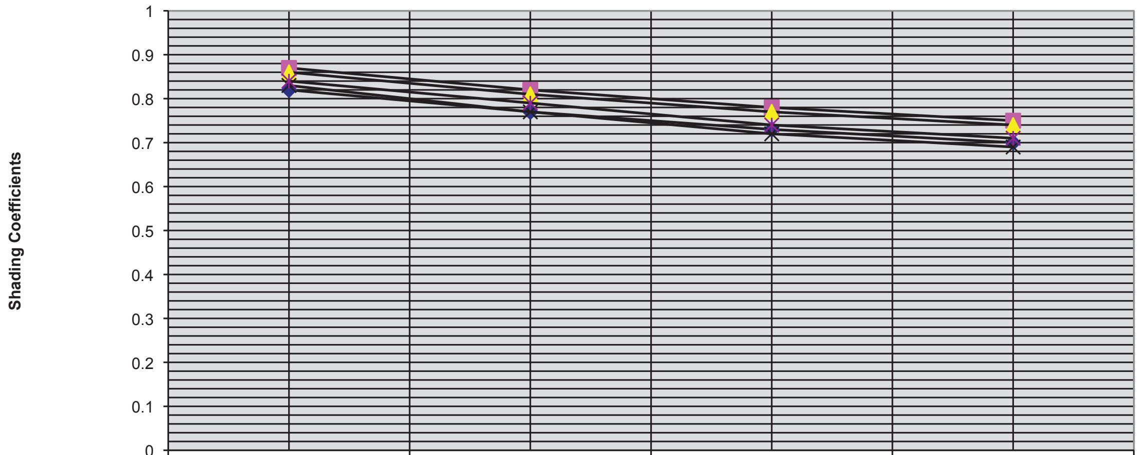
SC total = SC device x SC glass

Example for window above if SC shading Device is 0.8 and SC glass is 0.6 Total SC is 0.48 as illustrated below

SC total = 0.8 x 0.6 = 0.48

This combination would in effect shade more than 50% of the direct sunlight from entering through the window throughout the year.

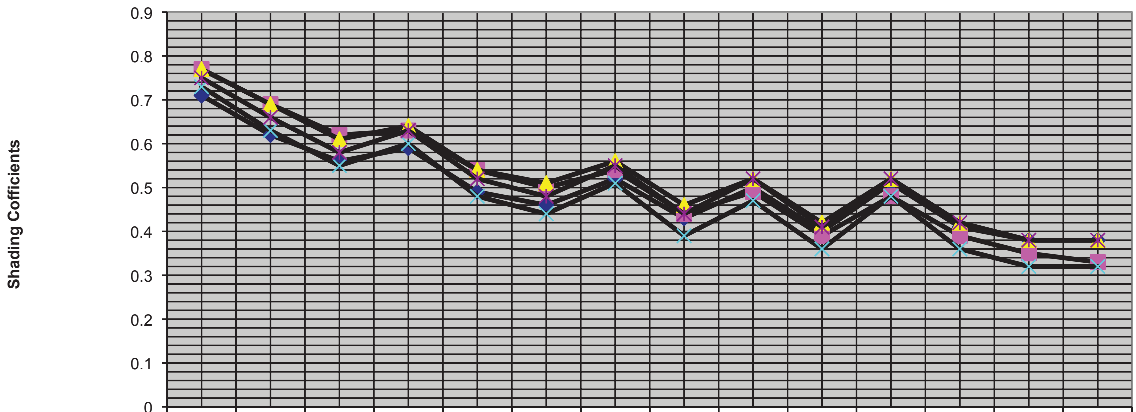
VERTICAL PROJECTIONS SHADING COEFFICIENTS (Table 6 of MS 1525)



	0.3 to 0.4	0.5 to 0.7	0.8 to 0.12	1.3 to 2.0
North/South	0.82	0.77	0.73	0.7
East	0.87	0.82	0.78	0.75
West	0.86	0.81	0.77	0.74
NE/SW	0.83	0.77	0.72	0.69
NW/SE	0.84	0.79	0.74	0.71

R2 (Projection / Window Width)

EGG CRATE SHADING COEFFICIENTS (Table 7 of MS 1525)



	0.20	0.4 to 0.6	0.6 to 0.8	0.2 to 0.4	0.6 to 1.2	1.4 to 1.8	0.2 to 0.6	0.8 to 1.8	0.2 to 0.6	0.8 to 1.8	0.2 to 0.4	0.6 to 1.2	1.4 to 1.8	0.2 to 1.8
	0.20	0.20	0.20	0.40	0.40	0.40	0.60	0.60	0.80	0.80	1.00	1.00	1.00	1.2 to 1.8
North/South	0.71	0.62	0.56	0.59	0.49	0.46	0.52	0.43	0.5	0.4	0.51	0.41	0.38	0.38
East	0.77	0.69	0.62	0.63	0.54	0.5	0.54	0.44	0.49	0.39	0.48	0.39	0.35	0.33
West	0.77	0.69	0.61	0.64	0.54	0.51	0.56	0.46	0.52	0.42	0.52	0.42	0.38	0.38
NE/SW	0.73	0.63	0.55	0.6	0.48	0.44	0.51	0.39	0.47	0.36	0.48	0.36	0.32	0.32
NW/SE	0.75	0.66	0.58	0.63	0.52	0.48	0.55	0.44	0.52	0.41	0.52	0.42	0.38	0.38

R1=Proj/WindowHeight R2=Proj/WindowWidth