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Design of Effective Shading Devices for Sri Lankan Residential Buildings

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ABSTRACT

According to international and national standards, new buildings are constructed to maintain high energy efficiency from both active and passive perspective, as well as excellent indoor environmental conditions. Electricity consumption accounts for the majority of energy consumption in homes. HVAC contributed to high energy consumption in buildings as a result of this. The HVAC load could be minimized by avoiding the heat gain inside the house. There have been several approaches adopted to prevent heat gain. One of the remedies is to develop an external shading device [1]. Developing an efficient external shading device will help minimize the amount of heat gained from the sun rays that fall into the building. However, there are no standard guidelines or standardsin the Sri Lankan context for shading devices. Hence, this study aims to provide a set of standards, including the dimensions needed to establish appropriate shading devices for Sri Lankan residential buildings. The orientation, climate, and sun path for a particular location needs to be studied to obtain the sun angle. The sun angles, which are the azimuth and the altitude, are the key factors used to calculate the dimensions for an effective shading device. Values were obtained using 3D sun path software by Dr. Andrew Marsh [2]. The calculations for shading device dimensions were carried out for all twenty-five districts in Sri Lanka for a number of standard window sizes that are being used in residential buildings. The shading lengths depend on the direction or the orientation of the window. The east and west-facing windows get the direct sunlight. Therefore, placing shading devices on those will not be effective compared to the windows oriented to north and south directions [3]. Hence, the lengths of the vertical and horizontal shading devices were calculated for the windows facing to north and south directions. Calculated dimensions were verified by modelling the shading devices using AutoCAD software. Thermal comfort and the cooling load of the building was determined using the Revit software by Autodesk.

Findings of this study show that the horizontal and vertical shading device lengths obtained for north-oriented windows are lower than the lengths obtained for south-oriented windows. This can be attributed to the higher altitude , and lower azimuth on the north side compared to the lower altitude and higher azimuth in the south-side. Sri Lanka being a small island, the variation of latitudes and longitudes within the country is insignificant. Therefore, though the lengths show a difference for each district, it does not vary in large numbers. From

the energy simulation results, it could be proved that thermal comfort could be increased using an effective shading device. The cost analysis proves that approximately five hundred Sri Lankan rupees could be saved from the electricity bill per month for an average residential house with a floor area of eighty-one square meters (81 m^2).

Keywords: *shading devices*

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