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Evaluating Daylight Performance in an Office Environment in Malaysia, Using Venetian Blind Systems

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Abstract : This paper presents fenestration analysis to study the balance between utilizing daylight and eliminating the disturbing parameters in a private office room with interior venetian blinds taking into account different slat angles. Mean luminance of the scene and window, luminance ratio of the workplane and window, work plane illumination and daylight glare probability(DGP) were calculated as a function of venetian blind design properties. Recently developed software, analyzing High Dynamic Range Images (HDRI captured by CCD camera), such as radiance based evalglare and hdrscope help to investigate luminance-based metrics. A total of Eight-day measurement experiment was conducted to investigate the impact of different venetian blind angles in an office environment under daylight condition in Serdang, Malaysia. Detailed result for the selected case study showed that artificial lighting is necessary during the morning session for Malaysian buildings with southwest windows regardless of the venetian blind's slat angle. However, in some conditions of afternoon session the workplane illuminance level exceeds the maximum illuminance of 2000 lx such as 10° and 40° slat angles. Generally, a rising trend is discovered toward mean window luminance level during the day. All the conditions have less than 10% of the pixels exceeding 2000 cd/m² before 1:00 P.M. However, 40% of the selected hours have more than 10% of the scene pixels higher than 2000 cd/m² after 1:00 P.M. Surprisingly in no blind condition, there is no extreme case of window/task ratio, However, the extreme cases happen for 20°, 30°, 40° and 50° slat angles. As expected mean window luminance level is higher than 2000 cd/m² after 2:00 P.M for most cases except 60° slat angle condition. Studying the daylight glare probability, there is not any DGP value higher than 0.35 in this experiment, due to the window's direction, location of the building and studied workplane. Specifically, this paper reviews different blind angle's response to the suggested metrics by the previous standards, and finally conclusions and knowledge gaps are summarized and suggested next steps for research are provided. Addressing these gaps is critical for the continued progress of the energy efficiency movement.

Keywords : daylighting, office environment, energy simulation, venetian blind
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