

Daylighting optimisation of double skin facades' perforation and shape in office buildings, in Cairo, Egypt.

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Abstract. Natural daylighting is a key indicator of how occupants are satisfied with their visual environment. Modern architectural facade designs are often characterized by ample transparent surfaces, thus an indeliberate design could encounter daylighting deficits or surplus. In Egypt, southern facades are over lit almost all year-round, and utilizing perforated double skin facades is one design strategy that helps achieve occupant's visual comfort, only if subtly designed and allocated. There have been several studies on the daylighting performance of perforated double skin facades, but only few have considered the design of their shape or perforation ratio, especially in Egypt. This paper aims to optimize the daylighting performance of perforated screens in office buildings in Egypt. For doing so, the study uses parametric design techniques to define the optimum perforation shape and ratio of a non-uniformly perforated screen of an office space, in Cairo. Performance metrics are the task plane illuminance and daylighting distribution, calculated on each solstice/equinox during three occupancy points in time. The results show that a total perforation ratio (PR) of 30% of rectangular shapes, most perforated around the fringes than the centre, achieve the optimal daylighting distribution of up to 83% in all seasons. Circular and triangular shapes with a PR of 27.5 and 26.2%, respectively, achieve a daylighting distribution of 85 and 75%, only in certain seasons.

Keywords: Daylighting, Parametric optimization, Double-skin-facade, Perforation ratio.

