

The Impact of Roof Thermal Performance on the Indoor Thermal Comfort in a Natural Ventilated Building Envelope in Hot Climatic Climates

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Abstract : Global warming has become a threat of our time. It poses challenges to the existence of beings on earth, the built environment, natural environment and has made a clear impact on the level of energy and water consumption. As such, increase in the ambient temperature increases indoor and outdoor temperature level of the buildings which brings about the use of more energy and mechanical air conditioning systems. In addition, in view of the increased modernization and economic growth in the developing countries, a significant amount of energy is being used, especially those with hot climatic conditions. Since modernization in developing countries is rising rapidly, more pressure is being placed on the buildings and energy resources to satisfy the indoor comfort requirements. This paper presents a sustainable passive roof solution as a means of reducing energy cooling loads for satisfying human comfort requirements in a hot climate. As such, the study based on the field study data discusses indoor thermal roof design strategies for a hot climate by investigating the impacts of roof thermal performance on indoor thermal comfort in naturally ventilated building envelope small scaled structures. In this respect, the traditional concrete flat roof, corrugated galvanised iron roof and pre-painted standing seam roof were used. The experiment made use of three identical small scale physical models constructed and sited on the roof of a building at the University of the West Indies. The results show that the utilization of insulation in traditional roofing systems will significantly reduce heat transfer between the internal and ambient environment, thus reducing the energy demand of the structure and the relative carbon footprint of a structure per unit area over its lifetime. Also, the application of flat slab concrete roofing system showed the best performance as opposed to the metal roof sheeting alternative systems. In addition, it has been shown experimentally through this study that a sustainable passive roof solution such as insulated flat concrete roof in hot dry climate has a better cooling strength that can provide building occupant with a better thermal comfort, conducive indoor conditions and energy efficiency.

Keywords : building envelope, roof, energy consumption, thermal comfort

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