

Reduction of Cooling Demands in a Subtropical Humid Climate Zone: A Study on Roofs of Existing Residential Building Using Passive

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Abstract : In sub-tropical humid climates, it is estimated most of the urban peak load of energy consumption is used to satisfy air-conditioning or air-coolers cooling demand in summer time. As the urbanization rate in developing nation - like the case in India is rising rapidly, the pressure placed on energy resources to satisfy inhabitants' indoor comfort requirements is consequently increasing too. This paper introduces passive cooling through roof as a means of reducing energy cooling loads for satisfying human comfort requirements in a sub-tropical climate. Experiments were performed by applying different insulators which are locally available solar reflective materials to insulate the roofs of five rooms of 4 case buildings; three rooms having RCC (Reinforced Cement Concrete) roof and two having Asbestos sheet roof of existing buildings. The results are verified by computer simulation using Computational Fluid Dynamics tools with FLUENT software. The result of using solar reflective paint with high albedo coating shows a fall of 4.8°C in peak hours and saves 303 kWh considering energy load with air conditioner during the summer season in comparison to non insulated flat roof energy load of residential buildings in Bhopal. An optimum solution of insulator for both types of roofs is presented. It is recommended that the selected cool roof solution be combined with insulation on other elements of envelope, to increase the indoor thermal comfort. The application is intended for low cost residential buildings in composite and warm climate like Bhopal.

Keywords : cool roof, computational fluid dynamics, energy loads, insulators, passive cooling, subtropical climate, thermal performance

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