

COMPARISON OF SUMMER AND WINTER THERMAL ENVIRONMENT IN TRADITIONAL VERNACULAR HOUSES IN SEVERAL AREAS OF NEPAL

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ABSTRACT

To evaluate and improve the thermal environment in traditional vernacular houses of the Banke, Bhaktapur, Dhading, Kaski and Solukhumbu districts of Nepal, an indoor thermal investigation and a questionnaire survey were conducted in the summer and winter. They were analyzed in terms of 1) the mitigation of thermal environment by residents, 2) the relation between living-space temperature and climate, 3) the temperature control effects by building materials, 4) the relation between indoor and outdoor temperature difference and altitude, and 5) a comparison of indoor and outdoor temperature difference in existing studies.

The findings on the thermal environment of investigated houses are as follows. 1) Residents mitigate the thermal environment by moving between indoor, semi-open and front yard spaces. 2) Living-space temperature was found to be very high in the sub-tropical climate in the summer (32.0 °C) and very low in cool climate in winter (6.5 °C). It is different according to climatic zones and seasons, which suggests that people have adapted to live with their natural environment. 3) The room temperature was 3.2K lower than the outdoor temperature during summer daytime, and 3.8-5.5K higher during winter nighttime. This is due to the effect of cool radiation in summer and heat storage in winter by the earth floor, stone walls and brick walls of the houses. 4) The indoor and outdoor temperature difference ($T_{in}-T_{out}$) was small in the low altitude location and large in the high altitude location. This is due to presence of open-type houses in low altitude locations and closed-type houses in high altitude locations. 5) Compared to Japanese houses, Nepalese houses are similar in $T_{in}-T_{out}$. This could be due to limitations of local building materials and the construction methods of traditional houses. The $T_{in}-T_{out}$ of Nepalese and Japanese houses was 1.2K in summer which is 1K smaller than in winter. The reason for this could be that residents open the openings in summer and shut them in the winter.

KEYWORDS

Nepal, Altitude, Sub-tropical climate, Temperate climate, Cool climate, Traditional vernacular houses, Indoor and outdoor temperature difference, Regional difference