

THERMAL ASSESSMENT OF TERRACE HOUSES CONSTRUCTED WITH LIGHT WEIGHT EPS BASED PANELS

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Terrace houses are used in many countries as a solution for the scarcity of land due to the ability to complete houses with smaller footprint and hence generally tend to reduce the cost incurred. However, there are drawbacks in the terrace houses in tropical climatic conditions due to restrictions on providing thermal comfort. Newly introduced lightweight Expanded Polystyrene (EPS) based lightweight concrete wall panel has less self-weight and less thermal conductivity and absorbs less heat to minimize this effect.

This detailed study was carried out to assess the applicability of EPS based lightweight concrete wall panels as the wall material of terrace houses with proper passive design in order to enhance the indoor thermal comfort. Three storey terrace houses have been developed to comply with the locally adopted building regulations. These houses have been assessed with the aid of computer simulations carried out using the DesignBuilder software using the climatic data pertaining to different climates. Comparative studies have been conducted to determine the thermal behaviour of the terrace house by modifying various factors in six ways. Such as materials, thickness, climatic condition, orientation of house cluster, floors and courtyard formations. As an outcome of these detailed studies a set of ideas and rules were developed for improvement in internal temperature.

In the first comparative study EPS based concrete has a minimum annual average indoor temperature ranging between 28° – 29°C which is nearly 2% less than concrete walls. Considering the thickness of EPS based walls, 150 mm thickness has a lower temperature value for each day. In the next comparative study, the orientation of the terrace house was compared for summer days. It is recommended that the row of houses should face either South or North to reduce the annual temperature to 28°C. By this, heat transfer into the house through glazing can be reduced. The fifth comparative study suggested that three storey buildings than one storey buildings should be built. The temperature can be reduced by 3-6% at lower floors than 3rd floor by avoiding overheating. The presence of courtyard is more welcome in terrace house to obtain natural ventilation and lighting. However, this may increase the overall temperature of houses under the influence of high solar radiation. In the final comparative study houses compared with various sizes of courtyards. Having small courtyards or covered courtyards may reduce these effects up to 29°C from 32°C. From the comparative studies carried out, the potential of using the lightweight EPS wall panels as load-bearing walls for three-storey terrace houses are shown as acceptable with respect to thermal comfortable in both tropical lowlands and uplands by using proper passive concepts.

Keywords: terrace house; thermal comfort; tropical climate conditions; EPS lightweight loadbearing wall panels; thermal conductivity

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