ABSTRACT

A major prerequisite of good design is to have sufficient knowledge of the climatic conditions of a given location. Since different locations within large areas have very similar climatic characteristics, these can be grouped together to form a more or less accurately defined climatic zone within which the climatic requirements for buildings are generally same with differences only due to local environmental conditions.

The classification of climate is an aid to the functional design of housing. There are two major climate classifications available namely, Bureau of Indian Standards (1978, reconfirmed in 1999) and climatic zones in India by N.K. Bansal and G. Minke (1988), for climatic designers in India. It is noted that the climate classification brought out by B.I.S. is accurate for the humid regions, as it further classifies into warm and humid, and hot and humid region. Based on the climatic data, the case studies area namely, Ennore, Tiruporur and Pondicherry come clearly under hot and humid region. A new comprehensive climate classification is generated after a detailed study on the climatic data. Accordingly in hot and humid region, the mean daily maximum dry bulb temperature is above 32°C and relative humidity above 40% prevail during the hottest month of the year and where altitude is not more than 500 m above mean sea level.

The characteristics of each climate differ and accordingly the requirements of comfort vary from one climatic zone to another. It is reasonable to assume that people living in hot countries mostly in unairconditioned buildings are acclimatized to and would accept, higher temperature and / or higher humidity.

The simplest strategy to improve thermal comfort in humid regions is by ventilation; providing comfort through higher wind speeds. There are two ways in
which ventilation can improve comfort in hot and humid regions i) opening the windows to let the wind in, and thus providing higher indoor air speed, makes people inside a building feel cooler. This approach is called comfort ventilation. The upper limit where the comfort ventilation can be used is up to 32°C. With an air movement of 1.5 m/sec to 2m/sec, depending upon the humidity level and acclimatization of the population ii) the other way is an indirect one; to ventilate the building only at night and thus cool the interior mass of the building. During the following day the cooled mass reduces the rate of indoor temperature rise and thus provides cooling effect. This strategy is termed as nocturnal ventilative cooling. For this to be effective diurnal range should be more.

Predominant house typologies were identified and documented for each of the 3 locations. Also, field measurements on air temperature, relative humidity and air movement were found to be matching with the climatic data.

The roof and wall elements were analysed for their thermal performance. A flow chart (programme) developed shows the methodology for thermal performance analysis. Following are the results and conclusions of the study.

1. A comprehensive climate classification incorporating the warm and humid region, and hot and humid region besides other types of climates is generated for India, which will be useful to climatic designers for future analysis, specially while designing in humid regions.

2. This report presents for the first time, a map of the hot and humid region of India, which will be useful to climatic designers.

3. It is observed that all the pucca house typologies displayed the same thermal strategies (i.e.) roof and walls used as heat sinks by way of thick roofs and thick walls.
4. It is also noted in all the 3 case study locations, that for six months (April to September) during the critical period nocturnal ventilative cooling strategy could be used and for the other six months (October to March) comfort ventilation as a strategy could be used.

5. Among the various house typologies, French house typology at Pondicherry with Madras terrace roofs performs the best. In addition, increased room height also brings down the internal temperature (It has been already proved that there is a drop of 0.3°C for every 30 cm increase in height).

6. Hut and Mangalore tiled roofs are the least thermally performing ones as seen from the analysis.

7. Among the walls, Tamil houses in Pondicherry and Tiruporur (wall to wall construction) performs well from thermal comfort point of view, because the radiation component of solair temperature is zero.

8. The traditional courtyard houses of this region are microclimate modifiers by providing better ventilation to internal spaces.

9. The simple methodology of evaluation of thermal performance of building elements is in the graphical language of designers. As such, there exists a gap between scientists and architects. This is an attempt to bridge this gap. A programme to compute internal surface temperature for use in evaluation of thermal performance of building elements is developed.

A comprehensive guideline for bio-climatic housing design is evolved for hot and humid climate.