Environmental quality analysis of local housing in mountainous regions of Guilan with an Emphasis on Thermal comfort (Case study: Dowsaledeh Village, Rudbar)

Farnaz Farasati*
Ph. D Candidate of Architecture, Art University of Esfahan, Esfahan, Iran

Farhang Mozaffar
Associate Professor, Dep. of Architecture and Urban Design, Iran University of Science and Technology, Tehran, Iran

Farshad Nasrollahi
Assistant Professor, Dep. of Architecture and Urban Design, Art University of Esfahan, Esfahan, Iran

Nasrollah molaei hashjin
Professor, Dep. of Geography, Rasht Branch, Islamic Azad university, Rasht, Iran

Received: 21/09/2017 **Accepted:** 25/12/2017

EXTENDED ABSTRACT

Introduction
Human beings have been long making shelters to deal with external factors and live with comfort. Later, scientists found that the higher the quality of the interior spaces of the built environment ranging from cooling or thermal comfort, audio and even better interior ventilation has a significant role in physical and, mental health of the residents. Because of the ruggedness and impassibility of the most mountainous regions, providing thermal comfort with fossil fuels needs electricity and gas grid, which is difficult to achieve, and is not cost-effective. On the other hand, making roads and power grids equals subsequent loss of hectares of forests and consequently tens of plant and animal species. Due to lack of this comfort, forest and mountain dwellers and tribal people are forced to wander and migrate unplanned to urban and suburban areas, which in turn have grounded serious problems. Accordingly, this article pays special attention to the indoor thermal comfort in mountainous settlements.
The case under study was located in Dowsaledeh village (Khorgam, Rudbar) and the main questions that were answered in this research are:
A. How can dominant native rural settlements of mountainous areas of Guilan be studied in terms of thermal comfort during the year on valid scientific methods?
B) In what period of the year do these settlements provide suitable thermal comfort and at what times will it be difficult.

Methodology
The case under study in Dowsaledeh village (Khorgam, Rudbar) was first plotted, the ground as well as the first floor plan was drawn, and then energy consumption was simulated using Design Builder. Then, Rudbar climate information was considered as the default for the software and the seasonal PMV diagrams (winter, spring, autumn, and summer) were drawn and analyzed. The results indicated that in spring and summer, the thermal behavior of native housing is appropriate, but by the end of summer and the beginning of autumn to early spring, thermal

* Corresponding Author: Email: farnaz_farasati@yahoo.com

behavior is inappropriate and heating is needed. In order to validate the software within a month from April 11 to May 11, 2017, a data logger was used to record the indoor information of the living room. Temperature and relative humidity diagram were recorded and compared with those of the software indicating very close results, which proved the validity of the software. Eventually, in the conclusion, two PMV diagrams were drawn, one with the data logger in the period from April 11 to May 11, 2017, and the other with the software information in the same interval. The two diagrams revealed the same results.

Result and Discussion

To conduct this research and to study the annual thermal comfort of residential buildings in the mountainous villages of Guilan, first a case with appropriate access and health was located, and its physical profile was recorded. In order to study the thermal performance of the interior space a rooms in the first floor was determined and environmental variables of air temperature and humidity during a month in spring from April 11 to May 11, 2017 were recorded at midday, by the data logger. In order to produce PMV and PPD, the variables used in Design Builder were:

A: Wind speed, which is among unstable weather parameters, was studies. This parameter is a function of the area and the place where the wind blows. In fact, the land not only affects the speed of the wind, but also affects its quality.

B: Relative humidity is the ratio of the actual moisture content of the air to the maximum moisture that is present in the air. As the temperature rises, the air volume to accommodate more moisture content increases.

C: Air temperature

D: The value of clothing insufficiency: It covers a part of the body and reduces contact with the surrounding area like a non-woven envelope (Zolfaghari, 2007).

E: Work that raises the metabolism flow: As the body's thermal efficiency is very low, a maximum of 20 percent of the heat generated is converted to work. A person sleeping generates about 41, a standing one about 70 and walking, about 116 watts per square meter of heat.

F: Average radiation temperature: The heat that is lost from the building is not felt. Only the heat that goes from our skin is sensible. The relationship between radiation and surrounding surfaces is described by the average radiation temperature (Bahadory Nejad & Yaghoubi, 2006).

The results indicated that in spring and summer, the thermal behavior of native housing is appropriate, but by the end of summer and the beginning of autumn to early spring, thermal behavior is inappropriate and heating is needed. In order to validate the software within a month from April 11 to May 11, 2017, a data logger was used to record the indoor information of the living room. Temperature and relative humidity diagram were recorded and compared with those of the software indicating very close results, which proved the validity of the software. Eventually, in the conclusion, two PMV diagrams were drawn, one with the data logger in the period from April 11 to May 11, 2017, and the other with the software information in the same interval. The two diagrams revealed the same results.

Conclusion

The results of the thermal performance of the above building indicate that in terms of providing thermal comfort, it has a good performance in spring and summer, but it faces problems in autumn and winter. Also, concluding the annual and monthly interior loads received from the parameters of equipment, lighting, solar radiation, and people in kWh it is determined that, spring and summer heat load is appropriate but autumn and winter load should be supplied. The amount of solar radiation absorbed in different months of the year and that the need to use new technologies such as photovoltaic's and solar collectors in cold weather is verified. Also by comparing seasonal inputs with (Matzarkis "s chart, 2001) the result were established that winter time has high coldness tension therefore vernacular architecture cannot provide comfort zone and heating system is needed. Although spring time is comfortable. Summer time the result shows warm and moderate warm that due to field convey and filling questioners by local

people they claimed they are comfortable and adapted so cooling system is not essential. Fall season due to the chart are cool with mild coldness tension that is satisfactory for dwellers except December that near to January month regards of decreasing in temperature and relative humidity heating system is crucial. On the other hand by using different construction materials including: Especial local material (Thickness Wood and fiber), Gypsum and concrete, Brick, Timber the result had shown that they had been acting differently in heating providence.

Key Words: interior spaces, thermal comfort, mountainous regions