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Impacts of Different Climate in Northern and Southern Regions on People's Thermal comfort in Winter

HaiyanYan[a,b], ZhangHao[b,*]

[a]*Henan Polytechnic University, Henan Provincial Engineering Laboratory of Ecological Architecture and Environment, Henan Polytechnic University, Jiaozuo, China. 454000*

[b]*School of Architecture and Art Design, Henan Polytechnic University, Jiaozuo , China 454000*

Abstract

In order to study the human thermal adaptation on the basis of region and climate on North and South. This paper gives a statistical analysis to the law of indoor and outdoor temperature effect on thermal sensation in different typical climate by field study and literature survey, based on human thermal comfort theory and method and combined with the region and climate of China. The analysis results that the Thermal reaction of the Northern give priority to the indoor climate, the thermal reaction of the Southern was mainly the outdoor climate.

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Keywords: Field study, thermal comfort, thermal reaction, air temperature;

1. Introduction

At present, most countries have adopted ASHRAE55-2004[1] and ISO7730[2] as the indoor thermal comfort standards, these standards are established by European and American scholars. In recent years, more and more researchers have found that there are differences in thermal adaptation model compared with foreign countries, based on different backgrounds and contexts of the climate. So we can not blindly take the foreign thermal adaptation model to guide China's indoor thermal environment design.

China's thermal comfort research began in 1993, TanFujun[4] was the first to carry out the investigation and

* Corresponding author. Tel.: 86-15838979866;
E-mail address: 13308925@qq.com

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Study on indoor thermal environment and comfort of office buildings in cold areas of China. In 1998, XiaYizai led scholars of Tsinghua University to conduct site test and send out questionnaire surveys for the heat comfort in Beijing's 88 residential buildings with natural ventilations[5].In 2002, Wang Zhaojun and other scholars took Harbin as the example to conduct site test for the winter internal environment parameters of residential buildings in severe cold areas. Based on ASHRAE7 point scales, questionnaire surveys were done for the heat comfort of residents[E]. As of now, China has released several regulations for heat comfort, including《The Regulations on the Measurement and Heat Comfort Conditions for Moderate Thermal Environment PMV and PPD Index》(GB/T18049-2000)[6],《Design Specifications for Heating Ventilation and Air Conditioning》(GB50019-2003)[7], and Design Standards for Energy Efficiency of Public Buildings (GB50189-2005)[8].All these regulations adopted the comfort standards for heating and air conditioned buildings, so as to create an even, stable and immutable environment. Meanwhile, the comfort temperatures are confined within a narrow scope: winter -18~24℃; summer -22~28℃.In fact, besides the central heating and the heated brick bed heating widely seen in the north China, most Chinese buildings have windows that can be opened (except for some major public buildings). A natural adjustment mode is adopted for the whole year in the south and the summer in the north, but there are no heat comfort standards specially designed for naturally adjusted rooms, which brought tremendous difficulties to the design and evaluation for naturally adjusted buildings. Therefore, the author referred to the results of field studies by previous researchers and analyzed the action law of internal and external average air temperatures (the regional climates of the south and the north) on people's thermal reaction. From there, the author attempted to establish a heat adaptation model featuring the natural adjustment mode for different regional climates in the south and the north.

Nomenclature

PMV	predicted mean vote
PPD	predicted percentage of dissatisfied
TSV	thermal sensation vote

2. Methods

2.1. Field Research Database

Field research of thermal comfort began in 1993 in China, and by far over one hundred field research papers on thermal comfort have been published on a national scale. According to the field research data of thermal comfort available in China, the two typical regional climates over Northern and Southern China have been basically covered.

The data analysis units used for thermal adaptive modeling in this paper are determined by the seasons and months in every independent research location, thus this paper divided the 25,684 sets of raw data into 108 analysis units, based on which the data was then classified, integrated and analyzed.

2.2. Method Integration for Clothing Thermal Resistance Calculation

At present, as for the field research of thermal comfort in China, there is a difference between various research teams in estimation of clothing thermal resistance, and this brings great difficulty to lateral comparison among the research results of different regional climates, as well as the summarization, collation and reanalysis of the field research data of nationwide thermal comfort. So, this paper performed conversion by other methods based on the calculation method of clothing thermal resistance recommended in Standard ASHRAE 55-2004.

For the additional thermal resistance of chair, in the existing more than 25,000 sets of thermal comfort data, chair, stool, sofa and any other horizontal surface that might be regarded as a chair couldn't provide 0.15clo thermal resistance during the research, so for a comparison of thermal resistance among the analysis units in the database, this paper would not consider the additional thermal resistance provided by chair, and this is consistent with the thermal resistance treatment method adopted by de Dear in Project RP-884.