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Analysis on climate adaptability of traditional villages in Lingnan, China--World Cultural Heritage Site of Majianglong Villages as example

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Abstract

Based on the numerical simulation in this paper, the local climate of the Majianglong traditional villages in the Lily Town city is analyzed, the influence of the village layout in the traditional villages on the wind environment and the adaptability of Lingnan traditional village layout to the regional climate is studied. The layout characteristics of Majianglong traditional village is the former pond after the village and comb layout. The results show that the traditional grid layout of MajiangLong village obviously influence the microclimate of residential street. The traditional grid layout and relative position of residential plays an important role to the micro-environment of indoor and courtyard. In summer, the area close to the entrance of the cold lane and the edge of residential buildings is a more comfortable wind environment. However, the residential space in the middle of traditional building layout maintains a better thermal comfort environment because of the isolation of street space.

Keywords: Lingnan area; Majianglong village; Adaptation of climate; Numerical simulation

1. Introduction

In 2007, 'Kaiping Diaolou and villages' declared the success of 'world cultural heritag', including the four Heritage Villages, which are Sanmenli Village of Chikan Town, Majianglong Villages of Baihe Town, Jinjiangli Village of Xiangang Town and Zili Village of Tangkou Town. The academic community increasingly concerns their history, culture, art, science and other aspects of the achievements and values. The

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article carries on the analysis to this type of Lingnan traditional villages in hometown of overseas Chinese. Taking Majianglong villages as the research object, through numerical simulation methods, the article discusses the adaption of Lingnan traditional village layout and environmental factors on the regional climate and tries to accumulate the experience of building outdoor environment with better thermal comfort under Linanan subtropical climate conditions.

2. Introduction of Majianglong village

2.1. Landform of the villages

The Majianglong villages are located in the southeast of Baihe town, Kaiping City, consisting of five small villages, named by Yongan, Nanan, Hedong, Qinglin and LongJiang. The villages are faced to Tanjiang River, located in the middle and lower reaches of Pearl River basin, backed by Baizu Mountain, with vast and fertile alluvial plains in both sides.

2.2. Climate of the villages

Kaiping belongs to Jiangmen city, which is located in Lingnan area, a subtropical low latitude area; lying low, always spring season through the year, warm and rainy, dense river network. According to the "Standards of the Residential Design of Heating Ventilation and Air Condition" GB50736-2012[1] appendix A, outdoor parameters table Richard: Jiangmen city is located in the east longitude 112 degrees, north latitude 22 degrees. Outdoor average wind speed is 2.0m/s in summer, SSW mostly, and 2.7m/s in winter, NE mostly. Sunshine is more than 1700 hours; the percentage of sunshine in winter is about 38%. The annual average temperature is about 22℃, with little change in all seasons. Occasionally there are typhoons and rainstorms in summer. The minimum temperature is 5℃ in winter, contrastively 38℃ highest in summer.

2.3. Layout of the villages

The spatial layout of traditional villages in Kaiping area can be divided into the outer special layout and inner spatial layout. The overall pattern of this is also called the 'village after pond' type. 'Village after pond' pattern performances typically in the layout inside the village, that is, in front of the neatly arranged residential buildings the pond is digging into a pool shape. Around the village there are plenty of characteristic plants, mainly including bamboos and banyan trees, and they insulate internal village space from external environment thus a closed space of a village is formed.

The main body of the village is a large neatly array of residential buildings, arranged in a typical 'comb-shape layout'. Majianglong Village groups were arranged from north to south, including Yongan Village, Nanan Village, Hedong Village, Qinlin Village and Longjiang Village. The two villages of Yongan and Nanan in the north were organized in grouping layout, while the other three villages are performed in linear layout. About the residents of the building group, the number of columns is greater than the number of rows. Large numbers of 'San-Jian Liang-Lang' style traditional houses are organized through the horizontal streets and vertical alleys on the chessboard shape homestead. The plane pattern of all village buildings is uniform, and the layout of the road conforms to the dominant wind direction of the summer monsoon, and the ventilation effect is good. Narrow streets and alleys can effectively reduce direct sunlight in summer in order to improve the indoor thermal environment.

3. Simulation design

3.1. Simulation measure

The computational fluid dynamics (CFD) as a wind environmental analysis method is adopted in this research, the PHOENICS as a CFD modeling and calculating software has been widely adopted at present.