

Strategies for creating good wind environment around Chinese residences



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ABSTRACT

Nowadays, Chinese New Urbanization Construction is in its early stage, and one of the main requirements is to improve residential comfort based on sustainable development strategy. Chinese residences are precious heritages to mankind, which reserves several thousand years of historical cultural information. Therefore, we have to keep original style of Chinese residences in the process of green building design and green building retrofitting. In this article, authors briefly described the characteristics of Chinese residences. And then wind environment around Chinese residences in cold region was analyzed from the aspect of wind speed and wind pressure by CFD method. The advantages and disadvantages of Chinese residences adapting to the local wind environment were figured out. At last, some strategies for creating good environment are put forward. It will have important theoretical significance and practical value to green building design and retrofitting in China.

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1. Introduction

The rapid development of urbanization in China can directly lead to strong regional demand of human, so promoting new urbanization construction is an essential choice in economic development strategy and people's livelihood. Due to complexity of construction industry, a lot of experts put forward many valuable opinions on new urbanization construction. Small town is a major strategy, the theme can be summarized as "New towns, New communities, New residences", and its specific meanings are "Low carbon, Improving urbanization layout, Harmonious development, Inclusive growth" (Si, 2010). Nowadays, Chinese New Urbanization Construction is in its early stage, where one of main requirements is to improve living comfort based on sustainable development strategy (Long, Liu, Wu, & Dong, 2009; Long, Liu, Li, & Chen, 2010; NPC, 2010; Yang, Zhao, & Liu, 2010).

According to reports issued by the Jiusan Society, rural residents are reducing at the rate of 1.6% per year, but building land area is increasing at the rate of 1% per year in China, so they have to spend billions of Yuan per year to build houses (Hua & Fu, 2013).

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The above methods cause great waste, but housing is very inefficient. Therefore, taking practice of urban construction, namely, unifying planning and constructing residential area are impossible at current. Chinese residences are microcosm of Chinese traditional culture, and are precious design heritage to mankind in architecture design (Chen, 2011; Shi & Zhao, 2011). For a long time, these buildings followed principle of working for human beings welfare and retaining strong connection to landforms and environment. The practice fully explained theory of "Ecology", and embodied philosophy of "Nature and Humanity" ideology. Due to difference of historical tradition, life custom, national culture conditions, esthetic idea, natural conditions and geographical environment, Chinese residences show a great deal of diversity (Schultz, Shriver, Tabanico, & Khazian, 2004; Wilkins & Christians, 2001). Therefore, it is not feasible to change Chinese residences' original forms and residents' living style.

Therefore, we have to keep original style of Chinese residences in the process of green building design and green building retrofitting. This paper analyzed wind environment of Chinese residences in China cold region by taking courtyard as an example from wind speed and wind pressure, and cold region in China is shown in Fig. 1 (MoC, 1993). The advantages and disadvantages of them adapting to local wind environment were figured out. At last, we put forward some strategies for improving wind environment. It will have important theoretical significance and practical value to green building retrofitting in China.

Courtyard is one of main forms of Chinese residences, which is mainly distributed in North China, Shandong Peninsula and Henan



Fig. 1. Map of China building climate region.

region, distribution of them in China is shown in Fig. 2. For courtyard in China cold region, it adopts the layouts of “Opening to sky and Surrounding by wall”. In national psychological culture, it interprets Chinese introversion and implication and traditional ethical code (Chen, Ya, & Wang, 1997; Wang & Liu, 2002). Furthermore, in combination with nature, it balances day lighting and natural ventilation, so these methods provide many evidences and directions for courtyard to obtain a good light and wind comfort.

2. CFD modeling

Wind environment around building directly affect building energy consumption and resident’s daily life. If natural ventilation is taken full use, building energy consumption can be reduced and air quality can be improved. Thus it’s of great importance to study wind environment around existing buildings for impelling

development of energy efficiency in buildings working. In recent years, Computational Fluid Dynamics has become one of main methods to analyze building wind environment. Compared with the traditional test methods, CFD method has the advantage of high precision, simple operation, time saving and cost efficiency, so the simulation method is widely used in many fields. In building field, CFD method can be effectively used to simulate wind environment under different conditions, and it must have wide application prospect (Montazeri & Blocken, 2012; Tominaga et al., 2008).

As shown in Fig. 3, Group (a) is the model for courtyard without wing-room and Group (b) courtyard with wing-room. The dimensions of these buildings are given in Table 1. In model, distance between building and boundary has a great influence on wind field. To make wind field develop free, distance between air inlet and building is set as 27.5m, which is equal to 5H, where H is ridge

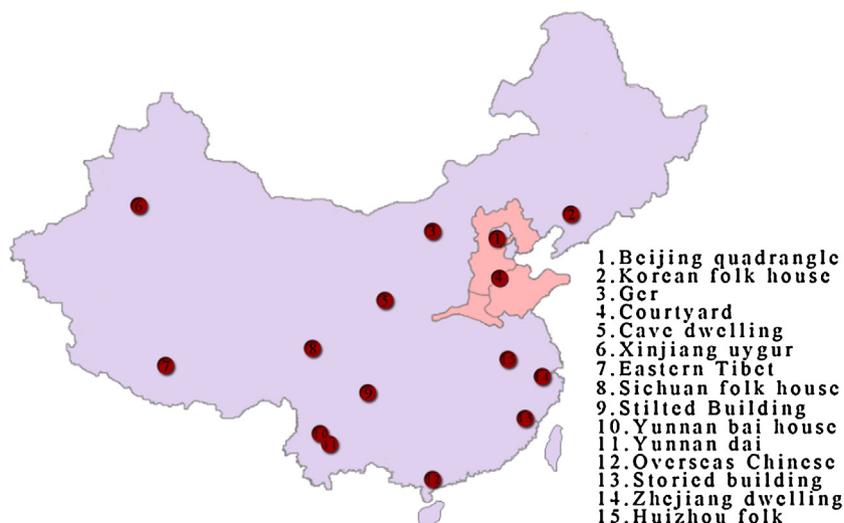


Fig. 2. Distribution of Chinese Residence.

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