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Improvement of Ventilation and Thermal Comfort Using the Atrium Design for Traditional Folk Houses-Fujian Earthen Building

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Abstract : Fujian earthen building which was known as a classic for ecological buildings was listed on the world heritage in 2008 (UNESCO) in China. Its design strategy can be applied to modern architecture planning and design. This study chose two different cases (Round Atrium: Er-Yi Building, Double Round Atrium: Zhen-Chen Building) of earthen building in Fu-Jian to compare the ventilation effects of different atrium forms. We adopt field measurements and computational fluid dynamics (CFD) simulation of temperature, humidity, and wind environment to identify the relationship between external environment and atrium about comfort and to confirm the relationship about atrium H/W (height/width). Results indicate that, through the atrium convection effect, it makes the natural wind guides to each space surrounded and keeps indoor comfort. It illustrates that the smaller the ratio of the H/W which is the relationship between the height and the width of an atrium is, the greater the wind speed generated within the street valley. Moreover, the wind speed is very close to the reference wind speed. This field measurement verifies that the value of H/W has great influence of solar radiation heat and sunshine shadows. The ventilation efficiency is: Er-Yi Building (H/W =0.2778) > Zhen-Chen Building (H/W=0.3670). Comparing the cases with the same shape but with different H/W, through the different size patios, airflow revolves in the atriums and can be brought into each interior space. The atrium settings meet the need of building ventilation, and can adjust the humidity and temperature within the buildings. It also creates good ventilation effect.

Keywords : traditional folk houses, atrium, tulou, ventilation, building microclimate
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