

Effects of Front Porch and Loft on Indoor Ventilation in the Renewal of Beijing Courtyard

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Abstract : In recent years, Beijing courtyards have been facing the problem of renewal and renovation, and the residents are faced with the problems of small house areas, large household sizes, old and dangerous houses, etc. Among the many renovation methods, the authors note two more common practices of using the front porch to expand the floor area and adding a loft. Residents and architects, however, did not give the ventilation performance of the significant interior consideration before beginning the remodeling. The aim of this article is to explore the good or negative impacts of both front porch and loft structures on the manner of interior ventilation in the courtyard. Ventilation, in turn, is crucial to the indoor environmental quality of a home. The major method utilized in this study is the comparative analysis method, in which the authors create four alternative house models with or without a front porch and an attic as two variables and examine internal ventilation using the CFD(Computational Fluid Dynamics) technique. The authors compare the indoor ventilation of four different architectural models with or without front porches and lofts as two variables. The results obtained from the analysis of the sectional airflow and the plane 1.5m height cloud are the existence of the loft, to a certain extent, disrupts the airflow organization of the building and makes the rear wall high windows of the building less effective. Occupying the front porch to become the area of the house has no significant effect on ventilation, but try not to occupy the front porch and add the loft at the same time in the building renovation. The findings of this study led to the following recommendations: strive to preserve the courtyard building's original architectural design and make adjustments to only the inappropriate elements or constructions. The ventilation in the loft portion is inadequate, and the inhabitants typically use the loft as a living area. This may lead to the building relying more on air conditioning in the summer, which would raise energy demand. The front porch serves as a transition place as well as a source of shade, weather protection, and inside ventilation. In conclusion, the examination of interior environments in upcoming studies should concentrate on cross-disciplinary, multi-angle, and multi-level research topics.

Keywords : Beijing courtyard renewal, CFD, indoor environment, ventilation analysis

Conference Title : ICGBTSD 2022 : International Conference on Green Building Technologies and Sustainable Design

Conference Location : New York, United States

Conference Dates : October 06-07, 2022