Abstract

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AERO-CONSCIOUS BUILDINGS: The Effect of Natural Ventilation on Form Generation of Non-Residential Buildings in Egypt

Natural ventilation is designed to maintain acceptable indoor air quality IAQ, with an indoor environment that lies within the comfort zone, while preserving energy use in building. This thesis deals with natural ventilation concepts confined in natural and hybrid ventilation strategies especially for non-residential building types in Egypt. It is affected mainly by wind velocity, wind direction and building form. In order to determine the effective building form elements responsible for driving natural ventilation, 12 contemporary naturally-ventilated non-residential buildings were analysed presenting a variety of building types, climate and ventilation concepts. Effective building form elements were classified into six main form categories. The effect of each element on ventilation performance is well studied based on either theoretical practical recent researches. Conceptual building form is generated by combining different effective form elements at different levels based on climatic analysis. Three main processes –prediction, simulation and field measurements –are used to make natural ventilation work effectively in the proposed building form. Computational fluid dynamics CFD have been promoted as a tool that combines fluid dynamics fundamentals with the latest digital technology to predict and simulate airflow within the tested model. The suggested methodology is tested on an educational casestudy in Egypt in order to evaluate and improve the existing ventilation performance, by modifying building form elements using CFD package FLUENT 6.2.16. A new building form is generated and offers a ventilation rate greater than the ASHRAE standard 62-2001 minimum requirements. The research concludes that any modification in building form settings could either improve deteriorate ventilation efficiency, and therefore, application of natural ventilation could generate Aero-Conscious building form that produces the best ventilation performance especially for non-residential buildings in Egypt.