Proposing Alternative Solutions to Enhance Natural Ventilation Rates in Residential Buildings in the Cfa Climate Zone of Rasht

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Abstract

Today, renewable resources and the crucial role of these types of passive strategies in energy efficiency among building sectors towards the sustainable development goals are more indispensable than ever. Natural ventilation has traditionally been considered as one of the most fundamental techniques to decrease energy usage by building dwellers and designers. The main purpose of the present study is to enhance natural ventilation rates in an existing six-story residential building situated in a humid climate of Rasht, during the summertime. On this basis, two types of ventilation systems, the Double Skin Facade-Twin Face System- (DSF-TFS) and Single-Sided Wind Tower (SSWT) were simulated through DesignBuilder version 4.5. Then, two types of additional ventilation systems were proposed in order to accelerate the airflow, including four-sided as well as multi-opening wind towers. Wind foldable directions were at about 45 degrees (Northwest to Southeast). The simulation results show that SSWT could have a better performance than the aforementioned systems by about 38%. Therefore, the multi-opening system was able to enhance the ventilation rate by approximately 10% during the summertime.

Image

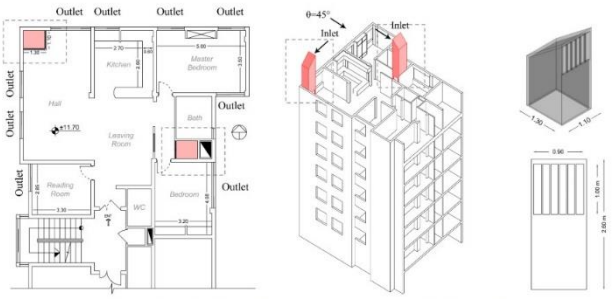


Figure 5. Locating the wind tower on the floor (isometric and plan view).

Recent Publications (minimum 5)

[1] Wu, Z.; Li, N.; Wargocki, P.; Peng, J.; Li, J. Cui, H. Adaptive thermal comfort in naturally ventilated dormitory buildings in Changsha, Chin, Energy Build 2019, 186, 56-70, https://doi.org/10.1016/j.enbuild.2019.01.029.

[2] Khelil, S.; Zemmouri, N. Biomimetic: a new strategy for a passive sustainable ventilation system design in hot and arid regions. Int J Environ Sci Technol 2019, 16(6), 2821 2830, https://doi.org/10.1007/s13762-018-2168-y.

[3] Hesaraki, A.; Myhren, J.A.; Holmberg, S. Influence of different ventilation levels on indoor air quality and energy savings: A case study of a single-family house. Sustain Cities Soc 2015, 19, 165-172, https://doi.org/10.1016/j.scs.2015.08.004.

[4] O' Donovan, A.; O' Sullivan, P.D.; Murphy, M.D. Predicting air temperatures in a naturally ventilated nearly zero energy building: Calibration, validation, analysis and approaches. Appl Energy 2019, 250: 991-1010, https://doi.org/10.1016/j.apenergy.2019.04.082.

[5] Edward, N.G. Designing High-density Cities for Social and Environmental Sustainability. Earthscan: London, UK, 2009.



Biography

My name is Shima Barati. I graduated in the architecture field. Then I got a bachelor of technological architecture engineering from Dehkhoda university. Also, I studied Master of Architecture at the Azad University, Karaj Branch. Moreover, I have learned about the value of traditional Iranian architecture. Hence, I believe an architect should consider several sorts of view to projects if it should have an acceptable plan to develop a project. That consists of regulating environmental conditions, sustainable product energy, ecological architecture, structure, design, mythology, psychology, sociology, anthropology, cultural items, mathematic, geometry, etc. Incredibly the most of these items had been in robust Iranian traditional architecture.

According to brilliant Iranian traditional architecture, some of my co-workers and I decided to do research work as a team. According to Iran's weather, regulating environmental conditions has played a crucial role in traditional Iranian architecture. Therefore, I am incredibly motivated about environmental architecture and also energy sources about architecture.

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