EFFECTS OF ARRANGEMENT OF BUILDING MASS AND DENSITY ON FISHING SETTLEMENTS FROM THE USE OF NATURAL VENTILATION
(Case Study: Cumpat dan Greges Barat, Surabaya)

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ABSTRACT

Indonesia is located along the equator and has a humid, tropical climate. Thus, it is necessary to design buildings that can adapt to these climatic conditions. The design of buildings must employ natural ventilation that results in comfort and provides both physical and physiological comfort. In order to accomplish this, much attention must be paid to the flow of wind around buildings. Three important aspects of building design related to wind flow are proper orientation, density, and arrangement of buildings such that these take into account the direction of the wind. This study sought to understand the requirements for the use of natural ventilation using wind power in order to understand how the movement of wind around buildings, resulting from certain arrangements of building mass and density, affects the physiological comfort of occupants.

This research was conducted using field measurements and computer simulation methods with CFD (Computational Fluid Dynamics) Fluent 6.2.16 to determine how the arrangement of mass and building density affect wind behavior and wind velocity. The arrangement of building mass and density determine the pattern of wind flow obstruction, that affect the performance of natural ventilation on fishing settlement.

The results of the research showed that the position of settlements on the ocean affect the character of the wind speed around the building. Certain arrangements of building mass and density result in obstructions that decrease the wind velocity required natural ventilation, up to half of the initial velocity. The field results indicated that the conditions of wind velocity and minimum wind velocity (WSc) in Cumpat are better than in the West Greges. This condition is influenced by the position of groups of residential buildings, building density, and the temperature and air humidity in the micro-environment. Similar conditions also applied to the results of a simulation showing that the wind velocity was above the value of WSc for a group of buildings because of the fact that they have a height of two-stories (windward), the venturi effect, and employ geometry that creates an open space. Special characteristics were found in the building group C (cluster) at a location in West Greges, which have corridor of 3m and decline gradually, providing a positive impact on the performance of natural ventilation and resulting in most of this area meeting demands for physiological comfort.

Keywords: CFD, building density, arrangement of building mass, fishing settlements.