UNIVERSITI TEKNOLOGI MARA

THERMAL COMFORT PERFORMANCE OF A NATURALLY VENTILATED CLASSROOM IN HOT HUMID TROPICS USING CASEMENT AND LOUVRES WINDOW DESIGN

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AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The effect of global warming and temperature change in this century has led to an issue of discomfort condition in the indoor environment. The thermal comfort performance of the indoor environment has a significant impact on occupants' performance, especially in the naturally ventilated educational buildings in hot and humid climates. Lack of guideline and less understanding of natural ventilation system concept creates another problem in naturally ventilated building. Therefore, this study aims to investigate the indoor thermal comfort performance of the naturally ventilated classroom using casement and louvres window. There were three objectives to be achieved, which are; (a) to identify the current condition in the case study classroom, (b) to analyse the thermal comfort condition of the case study classroom using ASHRAE Standard 55-2013 and Malaysian Standard; MS1525:2019 and (c) to determine which type of window that can improve the indoor comfort condition in a classroom. This study is a quantitative research which used an experimental approach to achieved the research objectives. The field experiment was conducted in a case study classroom and the reading of the data collection was selected for three days on a sunny day and clear sky. Two types of window design by considering the window to wall ratio (WWR) and percentage of openable glazing were suggested in this study to determine the suitable window design that will helps to improve the thermal comfort condition. A model of the classroom with casement and louvres window design was developed and simulated using a computerized simulation software to obtain the result of the thermal environmental parameters. The results were analysed according to ASHRAE Standard 55-2013, Malaysian Standard; MS1525:2019 and adaptive Fangers' Model. The analysis of the field experiment found that the average air temperature of Classroom A and Classroom B was 30.0°C and 29.4°C respectively, the average mean radiant temperature for Classroom A and Classroom B was 30.2°C and 29.4°C respectively, the average relative humidity for Classroom A and Classroom B was 67.2% and 69.6% respectively, while the average air velocity for Classroom A and Classroom B was 0.21 m/s and 0.43 m/s respectively. The result found that there was a discomfort condition in both classrooms at particular time. The analysis of simulation shows that the lowest value of the extension of Predicted Mean Vote (PMV*e*) found at the classroom with louvres window which is 0.41 and 0.48 for Classroom A and Classroom B respectively, while the lowest value of the extension of Predicted Percentage of Dissatisfied (PPD*e*) also found at the classroom with louvres window which is 8.55% and 9.87% for Classroom A and Classroom B respectively. This study found that the design of the window gives significant contribution to achieve thermal comfort in a hot humid tropic climate. The study concluded that the value of air temperature, operative temperature, air velocity, extension of Predicted Mean Vote (PMV*e*) and extension of Predicted Percentage of Dissatisfied (PPD*e*) shows a comfort condition in the classroom using louvres window with higher window to wall ratio (WWR) and larger percentage of openable glazing.

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