EFFECTS OF RADIANT COOLING ON THERMAL COMFORT IN ENERGY COMMISSION BUILDING IN PUTRAJAYA, MALAYSIA

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BY

SAAEED A. NEAMA AL-JAZAARI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

October 2013
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DEDICATION

This thesis is dedicated to

my beloved wife and kids
Abstract of thesis presented to the Senate of Universiti Putra Malaysia
In fulfilment of the requirement for the degree of Master of Science

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Faculty: Design and Architecture

This study presents the effects of radiant cooling on thermal comfort conditions in Energy Commission Building, Malaysia. Which is also known as The Diamond Building located in Putrajaya. It is equipped with radiant slab cooling. The main objective of this study was to determine the effects of radiant cooling on office workers’ thermal comfort conditions. The survey procedure was adopted from the ASHRAE 55 and the ISO 7730 standards. Survey questionnaire were administrated to office workers in the second and sixth floors. The data were analyzed through comparison with ISO 7730’s thermal environment evaluation requirements. In total, 132 data sets completed by 49 participants were collected. The data were collected continuously for four days (two days for each floor) during working hours. The survey data is comprised of two groups. The first group is the result of two online questionnaires, namely a background survey and a daily survey. The second group is comprised of three measurements namely the indoor climate, the radiant asymmetry, and the meteorology.

Findings of the thermal monitoring data suggests most of the thermal comfort conditions indices (excluding overall thermal comfort conditions) are within the recommended limits of the thermal comfort conditions standard of ISO 7730. However, the participants dissatisfied with the overall thermal environment. This dependent variable was compared with all of the independent variables in the background and daily surveys (personal variables, expectation, preferences, relative humidity, sweating, and head covering). The result was a high correlation with preferences for increased air speed ($p < .01$), additional fans ($p < .01$), and more fresh air ($p < .05$). Moreover, a high indoor relative humidity is recorded (due to not using dew sensor). A regression was found between sweating and comfort ($p < .01$). Another finding suggests that participants (males and females) who wore a head covering felt warmer than those who did not wear a head covering ($p < .01$). In conclusion, radiant cooling is not the main cause of thermal discomfort conditions in this building. However, the air supply, the relative humidity, the sweating, and head covering were the main cause of thermal discomfort conditions in this radiant cooling environment.
KESAN PENYEJUKAN BERSERI PADA KESELESAAN HABA
DALAM BANGUNAN SURUHANJAYA TENAGA DI
PUTRAJAYA, MALAYSIA

Oleh

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Hasil daripada data pemantauan terma mencadangkan bahawa kebanyakan indeks keselesaan terma (tidak termasuk keselesaan haba keseluruhan) adalah dalam lingkungan had yang disyorkan mengikut standar keselesaan terma ISO 7730. Walau bagaimanapun, hasil dapatkan mendapati kebanyakan subjek tidak berpuas hati dengan persekitaran haba secara keseluruhan. Didapati bahawa pembolehhabah bersandar mempunyai hubungkait dengan kesemua pembolehhabab bebas didalam kajie selidik latar belakang dan harian (iaitu pembolehhabah peribadi, jangkaan, keutamaan, kelembapan, dan tudung kepala). Kajian mendapati bahawa perkaitan yang tinggi dengan keutamaan bagi peningkatan kelajuan udara, kipas tambahan, kelembapan udara lebih segar. Selain itu, kelembapan dalam yang tinggi direkodkan (kerana tidak menggunakan sensor embun ). Regresi a didapati antara berpeluh dan keselesaan. Dapatkan menunjukkan bahawa peserta ( lelaki dan perempuan ) yang memakai tudung kepala berasa lebih panas daripada mereka yang tidak memakai kepala meliputi. Kesimpulannya, penyejukan berseri bukan punca utama keadaan ketidakselesaan terma dalam bangunan ini. Walau bagaimanapun, bekalan udara, kelembapan relatif, berpeluh, dan kepala
pegangan menjadi punca utama keadaan ketidakselesaan terma dalam persekitaran penyejukan ini berseri.
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APPROVAL

I certify that a Thesis Examination Committee has met on (18 October 2013) to conduct the final examination of SAAEED A. NEAMA AL-JAZAARI on his thesis entitled “Effects of Radiant Cooling on Thermal Comfort in Energy Commission Building in Putrajaya, Malaysia” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

SAAEED A. NEAMA AL-JAZAAR

Date: 18 October 2013
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