ADAPTIVE THERMAL COMFORT MODEL STUDY FOR PUBLIC BUILDINGS IN URBAN AREA

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Abstract

This thesis presents a comprehensive review of the literature of the Fanger's PMV and adaptive thermal comfort models which were developed in different buildings and climates. Basically, the adaptive thermal comfort model is the correlation between the indoor neutral temperature and the outdoor temperature. An important premise of this thesis is the fact that the Fanger's model underestimates the thermal impression in the actual case and thus the model is no longer valid for use in certain climates. As a consequence, many researchers have developed adaptive models from field studies for different climates and countries. However, there is still no adaptive model that can be applied in designing the air-conditioning systems for different buildings in all countries with the tropical climates including Malaysia. Based on this comprehensive review, internationally recognized adaptive models are needed to achieve better thermal conditions in a variety of buildings such as hospitals, offices and lecture halls in the tropics. For hot and humid climates, the adaptive thermal comfort models were developed as part of this research by using the collected results from a large field study in the hospitals, office buildings and lecture halls. Field measurements were conducted in nine hospitals with feedbacks from 293 workers. The relationships between the operative temperature and the behavioural adaptations were determined in this research. In the developed adaptive model for hospitals, the acceptable indoor neutral temperatures lay within the range of 23.3 - 26.5^{o}C, with the outdoor temperatures ranging between 25.4 - 35.0^{o}C. The neutral temperature, which is the most comfortable temperature for the hospital workers, was 26.4^{o}C. On the other hand, from the survey of the seven air-conditioned office buildings with 322 occupants, the acceptable indoor neutral temperatures found were within the range of 23.3 – 25.2^{o}C, with the outdoor temperatures ranging between 21.1 - 35.4^{o}C. The most comfortable temperature for office occupants was 24.1^{o}C. Furthermore, based on the field measurement in six lecture halls with 178 students, the acceptable indoor neutral temperatures lay within the range of 23.9 - 26.0^{o}C, with the outdoor temperatures ranging between 27.0 – 34.6^{o}C. The neutral temperature found for students in the lecture hall was 25.7^{o}C. Finally, the potential energy savings in the air-conditioning system was found to be 14.4 % for the hospitals, 0.6 % for the office buildings and 10.2 % for the lecture halls when increasing the temperature set point to the neutral temperature determined in the present research study.

Abstrak

Tesis ini membentangkan kajian literatur mengenai Fanger PMV dan model penyesuaian keselesaan terma yang dibina dari bangunan dan iklim yang berbeza. Pada asasnya, model penyesuaian keselesaan terma adalah hubungan antara suhu neutral dalaman dan suhu luar. Salah satu premis penting dalam kertas kerja ini adalah hakikat bahawa model Fanger meremehkan tanggapan terma dalam kes sebenar dan oleh itu tidak lagi sah untuk digunakan dalam iklim tertentu. Akibatnya, ramai penyelidik telah membina model penyesuaian daripada kajian lapangan untuk iklim dan negara-negara yang berbeza. Walau bagaimanapun, masih tiada model penyesuaian yang boleh digunakan dalam mereka bentuk sistem penyaman udara untuk bangunan yang berbeza di semua negara beriklim tropika termasuk Malaysia. Berdasarkan kajian semula yang komprehensif ini, model penyesuaian yang diiktiraf di peringkat antarabangsa adalah diperlukan untuk mencapai keadaan terma yang lebih baik dalam pelbagai bangunan seperti hospital, pejabat dan dewan kuliah di kawasan tropika. Untuk kegunaan sebagai model keselesaan terma yang lebih sesuai kepada iklim panas dan lembap, model penyesuaian keselesaan terma ini telah dibina sebagai sebahagian daripada kajian ini dengan menggunakan keputusan yang diperolehi daripada kajian lapangan yang menyeluruh di hospital-hospital, bangunan pejabat dan dewan kuliah. Ukuran lapangan telah dijalankan di sembilan buah hospital yang mempunyai 293 orang pekerja. Hubungan di antara suhu operatif dan penyesuaian tingkah laku juga telah ditentukan. Dalam model penyesuaian yang dibina untuk hospital, suhu neutral dalaman terletak dalam julat sebanyak 23.3 - 26.5^{o}C, dengan suhu luar antara 25.4 - 35.0^{o}C. Suhu neutral, yang merupakan suhu yang paling selesa untuk pekerja hospital adalah sebanyak 26.4^{o}C. Sebaliknya, daripada kajian di tujuh bangunan pejabat berhawa dingin dengan 322 orang penghuni, suhu neutral dalaman adalah dalam julat sebanyak 23.3

– 25.2^{o}C, dengan suhu luar antara 21.1 - 35.4^{o}C. Suhu yang paling selesa untuk penghuni pejabat adalah sebanyak 24.1^{o}C. Selain itu, berdasarkan kajian dalam enam dewan kuliah dengan 178 orang pelajar, suhu neutral dalaman adalah terletak dalam julat sebanyak 23.9 - 26.0^{o}C, dengan suhu luar antara 27.0 – 34.6^{o}C. Suhu neutral untuk pelajar dalam dewan kuliah adalah sebanyak 25.7^{o}C. Akhirnya, keupayaan penjimatan tenaga dalam sistem penghawa dingin yang didapati adalah 14.4% untuk hospital, 0.6% untuk bangunan pejabat dan 10.2% untuk dewan kuliah apabila meningkatkan titik suhu sistem penghawa dingin kepada suhu neutral yang didapati daripada kajian ini.

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List of Symbols and Abbreviations

B.U.	Bias Uncertainty
clo	Clothing insulation
met	Metabolic rate
T_{out}	Mean outdoor temperature
T_{op}	Operative temperature
T_n	Neutral temperature
T_{globe}	Globe temperature
AMV	Actual Mean Vote
ANSI	American National Standard Institute
APD	Actual Percentage Dissatisfied
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineering
CAV	Constant Air Volume
HVAC	Heating, Ventilation and Air-Conditioning
IAQ	Indoor Air Quality
IEQ	Indoor Environmental Quality
ISO	International Organization for Standardization
M&E	Mechanical and Electrical
MRT	Mean Radiant Temperature
NV	Natural Ventilated
PMV	Predicted Mean Vote
PPD	Predicted Percentage of Dissatisfied
VAV	Variable Air Volume

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Chapter 1 Introduction

Nowadays, a more comfortable and healthy environment in the buildings are expected, with a higher standard of living (Yu *et al.*, 2009). Hence, indoor air quality (IAQ) and thermal comfort of a building have become the main aims for HVAC engineers, because they are of great importance for high quality buildings (Kavgic *et al.*, 2008). For instance, better indoor air quality can be achieved with an increase of the ventilation rate, so that air pollutants can be diluted (Wargocki *et al.*, 2002). The way buildings are designed and operated means that the amount of energy used in the HVAC system and the impacts are important in constituting a 'comfortable' thermal environment (Brager & de Dear, 1998). Comfort problems will always occur after a period of operation due to reasons such as unsuitable temperature set points and improper fresh air intake.

As defined by the ANSI/ASHRAE Standard 55 (2004), thermal comfort is a situation where a person feels satisfied with the temperature of the surrounding environment. In designing a building involving people occupying it, the most significant aspect to be considered is the thermal comfort (van Hoof & Hensen, 2007). It is believed that the thermal comfort in a working space will affect workers' productivity (Mohamed & Srinavin, 2005).

The predicted mean vote (PMV) model developed by Fanger in the late 1960s and the current ISO 7730 Standard which are based on the PMV model were regularly used to determine thermal comfort of occupants in offices and residential buildings (van Hoof, 2008). Since the PMV model is used globally, the wide range of climates, variety of building types and the broad measurement of the thermal environment causes discrepancies between the actual and predicted thermal sensation. It is argued that the PMV model, which was developed from laboratory studies, has restrictions with regard to environmental parameters, since they are quite different from those in real buildings (Yao *et al.*, 2009).

Nowadays, most air-conditioned buildings with a centralized system face the same problem, which is either that the space is too cold or too warm (Wong *et al.*, 2007). A field experiment conducted in Singapore found that most of the air-conditioned office buildings were overcooled and approximately 33% of the occupants votes a cool thermal sensation (de Dear *et al.*, 1991). This is frequently encountered in tropical countries, because the PMV model is not suitable for a hot and humid climate. Thus, the adaptive model is important for establishing thermal comfort for occupants and at the same time conserving energy. The adaptive thermal comfort model is basically the correlation between the indoor neutral temperature and the outdoor temperature.

Until now, there has not been a study on an adaptive thermal comfort model for hot and humid climates in Malaysia. Thus, there is a need for researchers to conduct a comprehensive study on an adaptive thermal comfort model in Malaysia for the use of building service engineers from hot and humid countries. A comprehensive study should be performed for different kinds of buildings, such as hospitals, offices and lecture halls in order to determine the adaptive model for each of these specific buildings.

A hospital is a special building that has different requirements in Indoor Environmental Quality (IEQ) compared to other commercial buildings. For this study, the questionnaire survey was conducted among the hospital staff only, without considering the patients, because patients' thermal perception may vary depending on their health conditions. According to ASHRAE Applications (2007), recommendation for design temperature for inpatient areas should be 24°C or less.

The situation in hospitals is different to the situation in offices and lecture halls. Most office buildings are occupied from 8 am to 6 pm, and the recommended design temperature is from 23 to 26°C for the summer season (ASHRAE Applications, 2007). On the other hand, lecture halls are occupied by many students for a few hours for several times a day. The design of the lecture hall requires the air-conditioning system to run silently because students seated at the back of the lecture hall are nearer to the ceiling. The recommended design temperature for lecture halls is between 22.8 – 25.8°C. In specific terms, the lecture hall's temperature should be maintained at 24°C, without the existence of drafts as described in ASHRAE Applications (2007).

1.1 Objectives of study

The objectives of this research are:

a) To find out the relationship between the operative temperature and the clothing insulation, the activity level and the air velocity for hospitals, office buildings and lecture halls in Malaysia.

b) To determine the thermal acceptability and neutral temperature (which is the acceptable temperature range and the comfort temperature of the hospital personnel, office workers and tertiary students).

c) To develop the adaptive thermal comfort models with its upper and lower limits for the hospitals, offices and lecture halls based on the field study in Malaysia.

d) To verify the developed adaptive thermal comfort models by conducting an experiment in a chamber.

e) To compare the field survey results between the hospitals, offices and lecture halls.

f) To calculate the potential energy savings and the cost savings from the outcome of this research study.

1.2 Significance of study

In designing air-conditioning systems, it is believed that the conventional fixed temperature set point concept is inappropriate because the indoor comfort temperature actually depends on the outdoor air temperature. To have a thermal comfort model, which better fits hot and humid climates in Malaysia, the adaptive thermal comfort models proposed in this research were developed from the collected results from fieldwork study in hospitals, offices and lecture halls located in Kuala Lumpur, Malaysia.

The new conclusions from the adaptive thermal comfort models in this study could be used as an important guide for building services engineers and researchers in the tropics. Their intentions are to minimize energy usage in HVAC systems in hospitals, offices and lecture halls operating in the tropics while maintaining an acceptable thermal comfort level and thus improving the performance and well-being of the occupants.

Chapter 2 Literature Review

2.1 Thermal comfort

Fanger's model is a prediction of a numerical index by combining four physical variables and two personal variables to measure the perception of occupants on the thermal condition in a building (Charles, 2003; Deng *et al.*, 2009). The physical variables are air temperature, air velocity, mean radiant temperature and relative humidity. The two personal variables, meanwhile, are clothing insulation and activity level. Hence, a person's thermal sensation does not depend on the ambient air temperature alone. Thermal comfort is achieved when the heat produced by the metabolism is dissipated and is in thermal equilibrium with the surroundings.

In addition, thermal acceptability or the predicted percentage dissatisfied (PPD) can be determined from the PMV value. PPD is associated with three PMV ranges as shown in Table 2.1 (Arens *et al.*, 2010). Besides thermal comfort, energy consumption is another essential element that needs to be considered in HVAC systems because it determines the operating cost of the system as well as its effect on the environment. For this reason, a new method to determine indoor temperature and relative humidity to achieve minimum energy usage while considering human thermal comfort was developed (Wan *et al.*, 2009). Another study showed that in hot and humid areas, air velocity is the main factor for saving energy by reducing the cooling load of a building, because indoor temperature and humidity often do not guarantee indoor comfort (Yang & Su, 1997).

Table 2.1 : Thermal requirement of the three classes of indoor environment.

Class (category)	**A (I)**	**B (II)**	**C (III)**
PMV	-0.2 < PMV < +0.2	-0.5 < PMV < +0.5	-0.7 < PMV < +0.7
Temperature range for typical clo and met (K)	2	4	6
PPD (%)	<6	<10	<15

Source: (Arens *et al.*, 2010)

2.2 PMV model

The PMV was defined by Fanger as the index to forecast the mean thermal sensation vote for a big group of occupants based on a standard scale by taking into account the four physical variables and two personal variables aforementioned (van Hoof, 2008). The PMV model is a flexible tool, which can be utilized in different indoor environments with different HVAC systems, clothing values and activity levels. Besides, the PMV model is represented by a 7-point thermal sensation scale consisting of the following:

+3 Hot
+2 Warm
+1 Slightly warm
0 Neutral
-1 Slightly cool
-2 Cool
-3 Cold

Fanger related PMV to the imbalance between the actual heat flow from the body in a given environment and the heat flow required for optimum comfort at the specified activity by Equation (2.1) (ASHRAE Fundamentals Handbook, 2005).

$$\text{PMV} = [0.303\exp(-0.036M) + 0.028]\,L \tag{2.1}$$

M = metabolic rate

L = thermal load defined as the difference between the internal heat production and the heat loss to the actual environment for a person hypothetically kept at comfort values of skin temperature and evaporative heat loss by sweating at the actual activity level.

The PMV model can be called as a heat balance model because the thermal sensation in the PMV is interrelated with the thermal load from the mechanisms of the human thermoregulatory system (Fanger & Toftum, 2002). According to Fanger, thermal comfort can be accomplished when the body is in a heat balance, the average skin temperature and sweat rate are within certain limits, and no local discomfort occurs in the environment. Local discomforts are basically draughts or temperature gradients of the environment. Thus, high fluctuations in temperature should be avoided to achieve thermal comfort (van Hoof, 2008).

Field studies in tropical climates have found that Fanger's predicted mean vote equations do not effectively express comfortable conditions, especially in buildings which are not heated or cooled mechanically (Nicol, 2004). However, Nicol and Humphreys have demonstrated that errors in the PMV also exist in air-conditioned buildings (Nicol & Humphreys, 2002). The reasons for this occurrence of errors in predicting the mean vote include the constraints of the applicability of the PMV, wrong predictions of thermal sensation given by the steady-state heat balance approach (Nicol, 2004), occupants' adaptive behaviours (Humphreys & Nicol, 2002) and the limitations of the Fanger equation. One reason is that in the heat balance formula, the effect of air velocity should not only consider the convective heat exchange but also needs to take into account the evaporation of sweat (Heidari & Sharples, 2002).

Furthermore, it was also suggested that people might prefer not to feel 'neutral' on the thermal sensation scale, because occupants in hot climates might prefer a sensation of slightly cooler than neutral, while occupants in cold climates might prefer a sensation of slightly warmer than neutral (Humphreys, 1976). In other words, a majority of people would prefer a sensation on the warm side of neutral if it was cool outdoors and vice versa (Humphreys & Hancock, 2007). Therefore, the correlations between experimental data and mathematical models were studied (Buratti & Ricciardi, 2009). Few studies have been conducted in tropical countries to discover the acceptable temperature range, neutral temperature and preferred temperature in hot-humid climates. The results shown in Table 2.2 support the argument that the PMV model is not applicable worldwide because people's thermal sensation differs from place to place (Hwang *et al.*, 2006).

Table 2.2 : A list of neutral temperature of subjects in hot-humid climates.

Year	**1990**	**1991**	**1994**	**1998**	**1998**	**1998**	**2003**
Researcher	J.E. Bush	R.J. De Dear, K.G. Leow, et al.	R.J. De Dear, M.E. Fountain	T.H. Karyono	W.T. Chan et al.	A.G. Kwok	N.H. Wong et al.
Building	Office	Residential and office	AC office	Office	Office	Classrooms	Classrooms
Location	Bangkok, Thailand	Singapore	Townsville, Australia	Jakarta, Indonesia	Hong Kong	Hawaii, USA	Singapore
Neutral temperature of subjects	**24.5˚C** (ET) for AC buildings **28.5˚C** (ET) for NV buildings	**24.2˚C** (t_o) for AC buildings **28.5˚C** (t_o) for NV buildings	**24.2˚C** (t_o) in the dry season **24.6˚C** (t_o) in the wet season	**26.7˚C** (t_o) for AC buildings	**23.5˚C** (t_o) for AC buildings	**26.8˚C** (t_o) for AC classrooms **27.4˚C** (t_o) for NV classrooms	**28.8˚C** (t_o) for NV classrooms

Source: (Hwang *et al.*, 2006)

2.3 Adaptive approach

The adaptive approach states that if a variation occurs that leads to discomfort, people react in different ways to restore their comfort. The adaptive approach suggests that people's satisfaction with an indoor climate is attained by matching the actual thermal environmental conditions at the existing time and space with their individual thermal expectations (de Dear & Brager, 2002).

In Auliciems's research, there is a statistical relationship states that indoor air temperature is influenced by outdoor temperature (Auliciems, 1981). In the perception of the adaptive model, it can be said that thermal comfort temperature is a function of outdoors temperatures. Field studies show that in a naturally ventilated building, PMV predicts thermal sensations warmer than those that the occupants actually feel (Brager & de Dear, 1998). The adaptive process consists of three categories, which are physiological adaptation, psychological adaptation and behavioural adjustment.

2.3.1 Physiological Adaptation

Physiological adaptation is important in maintaining human body temperature at a comfortable level. This adaptation includes perspiration, vasoconstriction and vasodilatation (Yao *et al.*, 2009). Basically, physiological adaptation consists of genetic adaptation and acclimatization. Genetic adaptation is the genetic heritage of a person or a group of people, which has evolved over a long time, even before the individual's life began. In contrast, acclimatization is a change in a human's thermoregulation system in response to the thermal environment (Brager & de Dear, 1998). However, physiological acclimatization is not taken into account in the heat balance models as shown in Equation (2.1), and hence this variable is fixed.

2.3.2 Psychological Adaptation

Psychological adaptation is immeasurable, it describes a feeling of thermal perception based on past experiences (de Dear & Brager, 2002). The human body sensitivity will be reduced if exposed to a certain thermal level over a period of time. The static thermal heat balance models are not able to account for these psychological effects, and it is assumed that the relationship between psychological strain and thermal sensation is fixed.

2.3.3 Behavioural Adjustment

A behavioural adaptation is an action a person might take to achieve thermal comfort by changing their body's heat balance. Behavioural adaptation indicates that individual humans themselves can maintain their own thermal comfort. A person tends to take corrective actions if he/she is in a thermally uncomfortable condition. Behavioural adaptations are commonly represented by clothing insulation, activity level and air velocity as suggested by ASHRAE RP-884 (de Dear *et al.*, 1997). Air velocity is a parameter by which people apply some behavioural adjustments, either by opening/closing windows or turning on/off fans.

a) Clothing insulation

Clothing insulation, which is measured in the 'clo' unit, is basically an estimation of the insulating properties of clothing using tables from the ASHRAE Fundamentals Handbook (2009). In order to achieve thermal comfort, clothing plays an important role as one of the behavioural adaptations of humans.

According to some researchers, the linear regression between clothing insulation and operative temperatures was developed and shown in Equations (2.2) to (2.4).

$Clo = -0.04\ T_{op} + 1.73$ by (de Dear & Brager, 1998) (2.2)

$Clo = -0.04\ T_{op} + 1.76$ by (Mui & Chan, 2003) (2.3)

$Clo = -0.0352\ T_{globe} + 1.3875$ by (Bouden & Ghrab, 2005) (2.4)

Note that Equations (2.2) to (2.4) were developed from HVAC buildings, air-conditioned offices and free running buildings respectively. Researchers (Mui & Chan, 2003) also have found the correlation between clothing insulation and outdoor temperature for offices in Hong Kong as in Equation (2.5).

$$Clo = -0.0075\ T_{out} + 0.9898 \qquad (2.5)$$

b) Activity level

Activity level of occupants is measured in metabolic rate with the unit of 'met'. Most of the researchers found that the average metabolic rate for both centralized HVAC and naturally ventilated buildings is 1.2 met (Bouden & Ghrab, 2005; Mui & Chan, 2003). Also, the horizontal regression line between indoor operative temperature and metabolic rate found by the aforementioned researchers shows that the activity level of occupants is independent of the indoor operative temperature. The activity level for all office occupants is more or less the same where most of them are doing sedentary work no matter what their ambient temperature may indicate.

c) Air velocity

Another common behavioural adaptation is air velocity. People's adaptation to air velocity is different from air-conditioned buildings to naturally ventilated buildings. In air-conditioned buildings, people react to thermal comfort by adjusting temperature set-point, while in naturally ventilated buildings, people adapt by closing or opening windows. However, there is a condition where occupants do not have the individual adaptation opportunity. A centralized air-conditioned building does not give occupants an opportunity to have local control on their surrounding air velocity. In this case, the air velocity is governed by the air flow from the air-conditioning duct.

There are researchers that have found the relationship between air velocity and operative temperature in their studies. The correlation found by de Dear & Brager (1998) for air velocity and indoor operative temperature is as shown in Equation (2.6).

$$V = 0.03\ T_{op} - 0.56 \tag{2.6}$$

The correlation found by Mui & Chan (2003) is as Equation (2.7).

$$V = 0.02\ T_{op} - 0.35 \tag{2.7}$$

2.4 Studies on the adaptive thermal comfort model

A comprehensive review on the adaptive thermal comfort model, which is the relationship between indoor neutral temperature and outdoor temperature proposed by other researchers, is discussed further in this section. The research papers studied are on commercial and residential buildings. The study comprises both air-conditioned and naturally ventilated buildings. Also, the research papers chosen to be reviewed are from different kinds of climates such as seasonal, sub-tropical and tropical climates.

2.4.1 Study in sub-tropical Hong Kong

Many researchers from different countries have been interested in developing an adaptive thermal comfort model for the past two decades. A study on an adaptive model of air-conditioned building was carried out in sub-tropical Hong Kong by Mui & Chan (2003). Field measurements were taken in offices to measure air temperature, globe temperature, air velocity and relative humidity. Besides, questionnaires were distributed to occupants to collect the data on their thermal sensation vote, activity level and the clothing value of occupants. The adaptive model was developed based on the measurements from 29 offices in summer and 26 offices in the winter.

The result shows that the range of acceptable operative temperatures for summer and winter are 20.8–25.0°C and 19.5–21.5°C respectively. The neutral temperature, which is the operative temperature at mean thermal sensation vote of zero found from the study is 23.7°C in summer and 21.2°C in winter.

A correlation between indoor neutral temperatures and average outdoor air temperatures was developed by Mui & Chan (2003). The adaptive model generated is shown in Equation (2.8).

$$T_n = 18.303 + 0.158\ T_{out} \quad , \quad R^2 = 0.59 \qquad (2.8)$$

The slope of Equation (2.8) specifies that every 6°C increase of outdoor air temperature will give a 1°C increment in indoor neutral temperature.

Calibration on the proposed adaptive model for Hong Kong is needed in order to determine the upper and lower limits of the neutral temperatures. The capping confines the actual percentage dissatisfaction to be within 20%. The upper and lower limits were found to be 24.8°C and 19.1°C respectively as shown in Figure 2.1 (Mui & Chan, 2003).

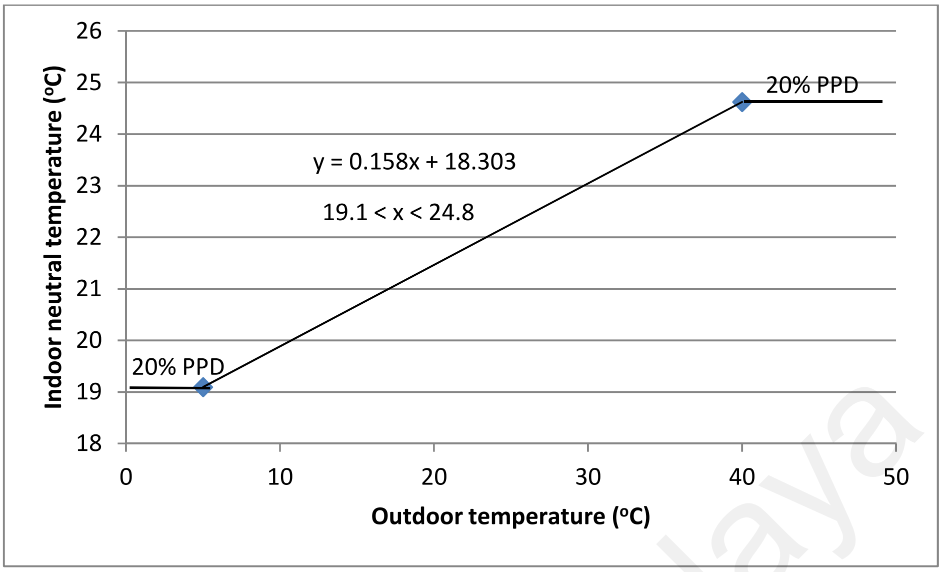

Figure 2.1 : Calibration of adaptive model for Hong Kong.

Source: (Mui & Chan, 2003)

2.4.2 Studies in five cities in Pakistan

A study was conducted to propose an indoor comfort temperature setting for commercial buildings in Pakistan (Nicol *et al.*, 1999). The study was conducted during both the summer and winter seasons in five cities. The details of the climates of each city are shown in Table 2.3. Five to seven buildings were chosen in each city and 10 to 30 occupants participated in the questionnaire survey in each building.

Table 2.3 : Climate of the five cities in Pakistan.

City	Climate	Monthly mean outdoor temperature (°C)
Karachi	Tropical Coastland	18.1 - 31.4
Multan	Sub-tropical Continental, Lowlands Arid	12.8 - 35.5
Quetta	Sub-tropical Continental, Highlands Semiarid/Sub-humid	4.9 - 27.8
Islamabad	Sub-tropical Continental, Lowlands Sub-humid	10.1 - 31.2
Saidu Sharif	Sub-tropical Continental, Highlands Humid	8.2 - 28.7

Source: (Nicol *et al.*, 1999)

Measurements for air temperature, globe temperature, relative humidity and air velocity were taken when the questionnaire survey on thermal comfort were distributed to occupants. The average metabolic rate of the occupants for each city ranged from 1.11 to 1.25 met. Out of 34 studied buildings, only one building had a centralized air-conditioning system. Most of the buildings were free-running buildings while a minority of them were mixed mode buildings with cooling systems.

The correlation between indoor neutral temperatures and monthly mean outdoor temperatures obtained for air-conditioned buildings in Pakistan is as shown in Equation (2.9) (Nicol *et al.*, 1999).

$$T_n = 18.5 + 0.36\ T_{out} \quad , \qquad R^2 = 0.73 \qquad (2.9)$$

The use of Equation (2.9) in determining neutral temperature could save energy in air-conditioning systems and reduce the maximum cooling load and thus its capital cost.

2.4.3 Study on two climatic zones of Tunisian

Besides the study in Hong Kong and Pakistan, there was another thermal comfort study carried out in Tunisia, in Africa. In summer, outdoor temperatures can rise to more than 40°C in the south, whereas during winter, the temperature can drop to around 0°C in the mountains in the North. The study was conducted in five towns with two climatic zones (Bouden & Ghrab, 2005).

The methods used for collecting data in this study were parameter monitoring and questionnaire survey. A total number of 200 occupants took part in the questionnaire survey with a range of metabolic rates from 1.2 to 1.3 met. There were four environmental variables taken during the survey. These variables were air and globe temperature, relative humidity and the cooling time of the Kata thermometer. The environmental parameters near the occupants were measured and recorded while the occupants were filling out the questionnaires (Bouden & Ghrab, 2005).

From the data analysis in the study, it was found that occupants in southern Tunisia were more satisfied with low temperatures than the occupants in northern Tunisia. Hence, it was concluded from the study that for all the five towns, there is a strong relationship between neutral temperatures and outdoor temperatures. The relationships are shown in Equations (2.10) and (2.11) (Bouden & Ghrab, 2005) where $T_{n\text{-Griffiths}}$ and $T_{n\text{-Brager}}$ is the neutral temperature calculated via Griffiths' and Brager's method respectively. The correlation is important in designing a comfortable indoor temperature.

$$T_{n\text{-Griffiths}} = 0.518\ T_{out} + 10.35\ , \qquad R^2 = 0.96 \tag{2.10}$$

$$T_{n\text{-Brager}} = 0.680\ T_{out} + 6.88, \qquad R^2 = 0.99 \tag{2.11}$$

2.4.4 Other studies related to an adaptive thermal comfort model

Besides the finding discussed above, there are also some other researchers who have proposed adaptive thermal comfort models in their own studies. According to Humphreys (Milne, 1995), the relationship between indoor neutral temperatures and monthly mean outdoor temperatures for air-conditioned buildings is given by Equation (2.12).

$$T_n = 18.6 + 0.16\ T_{out} \tag{2.12}$$

Auliciems also developed a correlation for both naturally and mechanically ventilated buildings using daily mean outdoor temperature as shown in Equation (2.13) (Auliciems & de Dear, 1986).

$$T_n = 17.6 + 0.31\ T_{out} \qquad (2.13)$$

Nicol proposed the adaptive model as shown in Equation (2.14) (Nicol, 1995) for Pakistan and Equation (2.15) (Nicol, 2004) for free-running buildings in tropical climates worldwide with T_{out} as the mean outdoor temperature.

$$T_n = 17.0 + 0.38\ T_{out} \qquad (2.14)$$

$$T_n = 12.9 + 0.534\ T_{out} \qquad (2.15)$$

Humphreys (1978) has determined a correlation for free-running buildings using daily mean outdoor temperature as shown in Equation (2.16).

$$T_n = 11.9 + 0.534\ T_{out} \qquad (2.16)$$

In another study, the relationship obtained by Humphreys & Nicol (2000) for free-running buildings with T_{out} as the monthly mean outdoor temperature is shown in Equation (2.17).

$$T_n = 13.5 + 0.54\ T_{out} \qquad (2.17)$$

In summary, based on all the findings above, it is noted that at the current stage, there is no study on an adaptive thermal comfort model conducted in buildings in hot and humid

Malaysia. Thus, a field work study in buildings in Malaysia is needed in order to develop an adaptive thermal comfort model for local use.

2.5 Discussion

2.5.1 Relation between PMV and AMV

As mentioned in the previous chapter, thermal comfort is a situation where the occupant feels satisfied with the indoor environment. The PMV model, which is based on a thermo-neutrality concept, was developed to determine the thermal comfort level for occupants inside a room or a building (van Hoof, 2008).

However, studies show that the PMV model underestimates thermal impressions because of the steady-state assumptions in the laboratory during the model derivation. Other than that, the metabolic rate and the clothing value derived from only a sampling study based on laboratory investigation may also lead to the inaccuracy of the PMV model. Thus, the PMV model is unsuitable for use in real buildings due to the unstable physical environment and metabolic rates (Chun *et al.*, 2004).

On top of this, the PMV model can only be used when occupants are exposed to a constant environment with a constant metabolic value for a long period of time. The reason for this is because the PMV model does not take into account the psychological and behavioural adaptations in the actual situation. Hence, the PMV model might be inaccurate for global applications since some of the model's parameters are not precisely specified (Brager & de Dear, 1998).

Field measurements were conducted by Buratti and Ricciardi by distributing questionnaires to occupants and using a special microclimatic acquisition system in the measurements. These researchers compared the PMV values obtained from both field measurements and questionnaires data. The findings showed that questionnaires data tends to give more discomfort conditions compared to the measurement data (Buratti & Ricciardi, 2009).

In addition to these results, Becker and Paciuk also found that the actual thermal sensation votes were reported higher than the predicted mean votes from the Fanger model (Becker & Paciuk, 2009). Since the PMV model was not accurate for application, an adaptive model is created according to different conditions. According to van Hoof, the PMV model can be improved by modifying the model itself or by increasing the precision of the input parameters of the model (van Hoof, 2008). Meanwhile, Humphreys and Nicol stated that the cause of the difference between the predicted mean vote and the actual mean vote are the variables in the PMV calculation (Humphreys & Nicol, 2002).

In order to overcome these discrepancies between PMV and AMV in warm climates, Fanger and Toftum recommended an expectancy factor, e, to be added to the PMV model. This factor could reveal why the PMV model does not comply with the occupants' actual mean votes in non-air-conditioned buildings. Thus, the expectancy factor could expand the usage of the PMV model, which was developed at a specific laboratory based on conventional heat-balance theory (Fanger & Toftum, 2002).

2.5.2 Variables in PMV

Fanger's PMV model was developed based on six variables, which include air temperature, mean radiant temperature, relative humidity, air velocity, metabolic rate and clothing insulation. If each of these variables introduces a minor error, this will eventually lead to a major error in the whole PMV model. The PMV model becomes more complex in heated or cooled buildings because an indoor temperature is dependent on the outdoor temperature (Nicol, 2004).

There are some suggestions from researchers all around the world on the matter of the PMV variables. Firstly, Mui and Chan suggested that indoor temperature should be set based on different occupations in a country with different climates (Mui & Chan, 2003). Then, Nicol showed that in a hot and dry climate, air temperature could be reduced by as much as 4°C with the presence of air movement. Humidity and air movement are important factors in reducing air temperature by heat lost through evaporation (Nicol, 2004). Wong et al also made a suggestion regarding the building facade, especially at the window opening area. By having a higher air movement from the window area, occupants' thermal comfort could be improved (Wong *et al.*, 2002).

In contrast, another research study showed that in order to achieve thermal comfort in a moist environment, the air temperature should be at a low level. This is because occupants might feel thermal discomfort even from small changes in temperature in a moist environment compared to a dry environment. Generally, loss of metabolic heat by convection and radiation will be reduced in hot conditions and most of the body heat losses are through evaporation. In this condition, it is necessary to note that the higher the humidity, the higher the discomfort level (Nicol, 2004).

Other than that, there are also studies that found that metabolic rate is related to one's activity level rather than the environmental temperature (Bouden & Ghrab, 2005). Goto et al stated that metabolic rate is controlled by a human's body mass, fitness and blood flow (Goto *et al.*, 2002). Finally, there is a study showing that heat transfer through multiple layers of clothing should be taken into account in determining thermal comfort (van Hoof & Hensen, 2006).

2.5.3 Uncertainty in PMV

The fundamental principle of an adaptive model is that people will take any action to achieve thermal comfort if there are any changes that generate discomfort (Nicol & Humphreys, 2002). Hence, the adaptive actions are of significant importance in order to attain a better thermal comfort environment (Feriadi & Wong, 2004). These actions are called behavioural adjustments, which were not considered in a PMV model. Occupants will make behavioural adjustments, such as take off clothing, open windows, turn on a fan or take cold drinks when they feel thermal discomfort. These actions are performed to achieve the individual's own thermal comfort (Yao *et al.*, 2009). Thus, to a certain extent, the static heat balance model could be partially adaptive from the behavioural aspect because it considers the clothing value, activity rate and indoor air parameters, which can be modified by the occupants (Brager & de Dear, 1998).

Besides, before making any prediction, it is important to make sure the input data, which includes the four environmental parameters, activity rate and clothing insulation are measured properly and carefully. In contrast, researchers Sekhar and Ching found a strong relationship between air velocity, relative humidity, temperature, PMV and PPD (Sekhar & Ching, 2002). Hence, set points of variables should be examined because a change in one of the variables will affect the value of the other variables. Moreover, most of the predicted values overestimated both air velocity and air temperature (Cheong *et al.*, 2003).

During fieldwork measurements, it was difficult to measure clothing values precisely. The error of the calculated clothing value can reach up to 20%, depending on which algorithms and tables or charts are being used (Brager *et al.*, 1993). For activity level, the measurement of metabolic rate should be as accurate as possible in order to achieve precise thermal comfort evaluation. This is because for a person who is either walking or seated quietly, both activities will affect different heat and energy dissipation (Wang *et al.*, 2006). Thus, incorrect measurement of activity rate and clothing value might lead to PMV inaccuracy (van Hoof, 2008).

In another example, Nicol & Raja (1996) conducted a two-day survey in Oxford Brookes University, in which they found that the body effective surface area can be reduced by 2% with every degree increment in temperature when a person changes his/her posture with regard to temperature. It was also noted that a person's thermal sensation votes are different between indoor and outdoor settings. Thus, the indoor thermal comfort model is not appropriate to be used for outdoor environments (Peter, 2002). Moreover, in air-conditioned buildings, occupants have higher expectations on the thermal environment. They prefer a uniform and cool environment and are very sensitive to any small changes in the thermal environment (de Dear *et al.*, 1997).

Besides the factors described above, there are other minor factors affecting the PMV model. Individuals in every country in the world have different perceptions on the thermal comfort level (Humphreys, 2005). Thus, the thermal comfort standard should be adjusted for people from different countries (Wang, 2006). Some studies found that elderly have similar comfort perceptions as younger ones. Nevertheless, the elderly might prefer higher ambient temperatures, since they have a lower basal metabolism and activity level (Havenith, 2001; van Hoof & Hensen, 2006). Furthermore, people could express different views when answering the questionnaires, even if they share the same culture and stay in the same area with the same climate (Kuchen & Fisch, 2009).

2.5.4 The importance of an adaptive model

Since the 1990s, researchers have been suggesting a better thermal adaptation and occupants' thermal comfort to future service engineers and architects. The building service engineers should focus more on the indoor climate and 'human aspects' in order to include adaptive models in their building design work (Barlow & Fiala, 2007). By having this functional design, a building can achieve the thermal comfort level expected by occupants while at the same time reducing energy usage (Karyono, 2000).

Other than that, Al-Homoud et al has stated that with low energy consumption, thermal comfort can still be accomplished when air-conditioning in an intermittent process is combined with a proper operational zoning strategy (Al-Homoud *et al.*, 2009). A special tool exists, where a computer-aided design for architectural and environmental purposes is able to calculate and enhance thermal comfort and optimize energy consumption in a building (Kumar & Mahdavi, 2001).

Wagner et al stated that adaptive thermal comfort models can predict the thermal sensation of occupants better than those with a predetermined indoor temperature setting (Wagner *et al.*, 2007). A passively cooled and naturally ventilated building can achieve a high level of thermal comfort during summer if it is designed appropriately, based on indoor climate. However, in an air-conditioned building, occupants' actual thermal comfort range might not lie within the temperature range recommended in the standards. In this situation, the adaptive model plays an important role in ensuring thermal comfort for occupants.

2.6 Summary

In summary, even though many amendments have been made to the Fanger PMV model, there is still no comfort model that can be applied globally. The reason for this is that every individual's expectation of the comfort temperature is different, and it is difficult to design a thermal comfort model that is preferred by a large group of people around the world. Furthermore, standard thermal neutrality is not necessarily the perfect thermal environment, since many occupants prefer a non-neutral environment.

According to ASHRAE RP-884 (de Dear *et al.*, 1997), amendments were made to the PMV model based on 21,000 sets of raw data from 160 buildings around the world. Nevertheless, all the data were collected up to the year 1997 only. Hence, a new set of thermal comfort data is required in determining adaptive models because of the significant climate change after a decade. The local adaptive thermal comfort models are needed for M&E services engineers and architects in designing their building HVAC systems to achieve a high thermal comfort level and optimizing energy usage for different types of buildings.

The methodology will be described in the next chapter.

Chapter 3 Methodology

The development of an adaptive thermal comfort model consists of several stages. These stages were described as below:

Stage 1: Literature Review

Relevant journal papers, conference papers, standards, reports, thesis and books related to this research topic were searched and studied to understand the scope of research.

Stage 2: Application to conduct fieldwork

Application letters were sent to the management department of the hospitals, offices and lecture halls in order to get the permission to conduct fieldwork to measure data required for this research project.

Stage 3: Fieldwork Study

After obtaining approval from the respective management departments, fieldwork was carried out in different hospitals, office buildings and lecture halls. Physical variables on indoor and outdoor air temperature, globe temperature, air velocity, relative humidity were measured and recorded. At the same time, subjective measurements were conducted by distributing questionnaires to the occupants to survey on their thermal comfort sensation, activity level and clothing insulation. The details of the questionnaires are as shown in Appendix A.

Stage 4: Development of the adaptive model

Data collected from the physical and subjective measurements were analyzed and plotted in graphs. The adaptive thermal comfort model, which is the linear regression between neutral temperature and outdoor temperature for hospitals, offices and lecture halls were developed.

Stage 5: Verification of the adaptive model

The proposed adaptive thermal comfort model for hot and humid Malaysia was verified by conducting an experiment in a chamber with 10 occupants sitting and working inside.

Stage 6: Calculation of potential energy savings

The amount of energy and cost saving that could be achieved when implementing the results obtained in this field study was calculated.

Final stage: Thesis report

Thesis report was written at the final stage of this research study.

3.1 Location of Measurement

This research was conducted at hospitals, offices and lecture halls in hot and humid, Kuala Lumpur, Malaysia. The nine hospital buildings surveyed were the

1) University of Malaya Medical Centre (UMMC)
2) Hospital Putrajaya
3) Hospital Sungai Buloh
4) Hospital Selayang
5) Hospital Klang

6) Hospital Kajang

7) Hospital Kuala Kubu

8) Hospital Banting

9) a private hospital (Private Hospital), the actual name is kept anonymous as requested by the management.

All the hospital buildings use the centralized air-conditioning system. Measurements were conducted at the staff rooms, nurse counters and the working space of the hospital personnel, depending on the department visited.

A survey was also conducted in seven office buildings and six lecture halls in Malaysia. The actual names of the offices are kept anonymous as requested by the management. The lecture halls are Lecture Hall A to Lecture Hall F, which are Dewan Kuliah 1 to 6, located in the Faculty of Engineering, University of Malaya. All the offices and lecture halls surveyed used a centralized air-conditioning system. Measurements were conducted at the occupied space in both the office buildings and lecture halls. For the offices, the occupied space is the open-plan shared offices instead of individual offices. Since all the buildings studied were using the centralized air-conditioning system, the individual occupants do not have control on the set-point temperature.

3.2 Field measurements

According to the ANSI/ASHRAE Standard 55 (2004), the air temperature, globe temperature and air velocity has to be measured at the ankle, waist and head levels. These levels are 0.1 m, 0.6 m and 1.1 m, respectively, above the floor for sitting occupants, and 0.1 m, 1.1 m and 1.7 m for standing occupants. However, relative humidity was measured at 0.6 m above the floor for sitting occupants and 1.1 m for standing occupants. These thermal comfort parameters together with the outdoor temperatures were measured by using TSI Alnor Thermo Anemometer, KIMO Thermocouple thermometers and KIMO Temperature and Humidity data logger as shown in Table 3.1.

Table 3.1 : Instruments description.

Type of instruments	Measurement parameter	Accuracy
TSI Alnor thermo Anemometer (Model 440-A) 	• Temperature • Relative Humidity • Air velocity	_Operating range_ Temperature:-10 to 60^{o}C RH: 0 to 90% Velocity: 0 to 30 m/s _Accuracy_ Temperature: ± 0.3 ^{o}C RH: ± 3% Velocity: ± 3% of reading or ± 0.015 m/s, whichever is greater _Resolution_ Temperature: ± 0.1 ^{o}C RH: 0.1% Velocity: 0.01 m/s
KIMO Thermocouple thermometers (TK100) 	• Globe temperature	_Operating range_ From -200 to 1300°C _Accuracy_ ± 1.1 ^{o}C or ± 0.4% of reading, whichever is greater _Resolution_ 0.1^{o}C
KIMO Temperature and Humidity Datalogger (KH-100-AO) 	• Temperature • Relative Humidity	_Operating range_ Temperature:-20 to 70°C RH: 5 to 95% _Accuracy_ Temperature : ± 1% of reading or ±0.4^{o}C, whichever is greater RH: ± 2.95%

3.2.1 Calculation of operative temperature and mean radiant temperature

Operative temperature is used in defining comfort conditions throughout this thesis. Operative temperature is the average of the mean radiant temperature (MRT) and the ambient air temperature, weighted by their heat transfer coefficients. However, in usual practical applications as described in McQuiston *et al.* (2005), the operative temperature is calculated as the average of MRT and the ambient air temperature without considering the heat transfer coefficient as shown in Equation (3.1). The MRT is calculated using Equation (3.2) (McQuiston *et al.*, 2005).

$$T_{op} = \frac{(T_{mrt} + T_a)}{2} \tag{3.1}$$

$$T^4{}_{mrt} = T_g^4 + C\overline{V}^{1/2}(T_g - T_a) \tag{3.2}$$

where,

T_{mrt} = mean radiant temperature, K

T_g = globe temperature, K

T_a = ambient air temperature, K

$\overline{V}$ = air velocity, m/s

C = 0.247 x 10^9

3.3 Subjective measurements

In parallel with the field measurements, occupants were requested to fill in the questionnaires as shown in Appendix A. The questionnaires included the survey on occupants' personal particulars, comfort votes, activity levels and clothing insulation. The details in the questionnaires were explained before the occupants answered the questions.

3.3.1 Calculation of Clothing Value

Clothing insulation which is measured in the 'clo' unit, is basically an estimation of the insulating properties of clothing using table from the ASHRAE Fundamentals Handbook (2009) as shown in Appendix B. The clothing value is determined from the aforementioned table based on occupants' garment checklist in the questionnaires. The clo value of a person is calculated by adding together all the clo value of each garment that the person was wearing. Note that the clothing value of occupants in this research study is without taking consideration of the chair insulation.

3.3.2 Calculation of Metabolic Rate

Activity level of occupants is measured in metabolic rate. The metabolic rate is determined based on the questionnaires filled by occupants and the table in ASHRAE Fundamentals Handbook (2009) as shown in Appendix C. Both the metabolic rate and clothing insulation were calculated as the average value over a period of half an hour to one hour after the physical measurements, as recommended by the ANSI/ASHRAE Standard 55 (2004).

3.3.3 Calculation of PMV and PPD

In this study, the actual mean vote (AMV), which is the comfort votes collected from the questionnaires is compared with the predicted mean vote (PMV), which is calculated based on Fanger's thermal comfort model. The ASHRAE Thermal Comfort Program (1995) is used to calculate the value of PMV and the predicted percentage of dissatisfied occupants (PPD). This program was developed by Marc Fountain, Environmental Analytics at UC Berkeley.

The sample of the program is shown in Figure 2.1. The program inputs are the air temperature, MRT, air velocity, relative humidity, activity level and clothing insulation of the occupants. The desired outputs are PMV and PPD. From Figure 2.1, the parameters to be entered are on the left column and the results generated are on the right column.

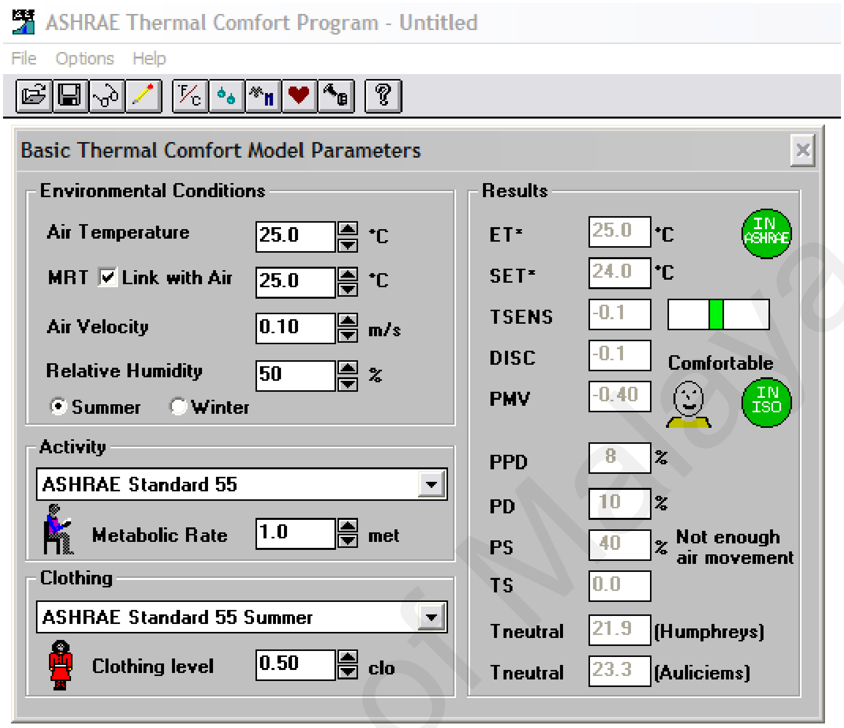

Figure 3.1 : ASHRAE Thermal Comfort Program.

3.4 Verification of the adaptive model

The adaptive thermal comfort model proposed in this thesis was verified by conducting an experiment in a centralized air-conditioned chamber in the Faculty of Engineering, University of Malaya with 10 occupants sitting and working inside. The details of the 10 occupants are shown in Table 3.2. They performed sedentary work and wore clothing of an average of 0.41 clo. During the experiment, the room temperature was adjusted at a range of 23 - 27°C. The experiment took about four hours for every 1°C temperature increment. The subjects were asked to fill in the questionnaires on their thermal sensation and personal variables such as clothing value and activity level after every two hours during the experiment period.

Table 3.2 : Details of the 10 occupants participated in the verification experiment.

No.	Name	Staff / Student	Gender	Age
1.	Yau Yat Huang	Staff	Male	40-50
2.	Kazi Md. Salim Newaz	Staff	Male	40-50
3.	Mahidzal bin Dahari	Staff	Male	30-40
4.	Ahmad Badarudin bin Mohamad Badry	Staff	Male	30-40
5.	Phuah Kok Sun	Staff	Male	20-30
6.	Ding Lai Chet	Staff	Male	20-30
7.	Lian Yee Cheng	Staff	Male	20-30
8.	Chan Hon Ki	Student	Male	20-30
9.	Tommy Chang	Student	Male	20-30
10.	Shafawati Shahneel	Student	Female	20-30

The aforementioned experiment was used to verify the adaptive models developed for hospitals, office buildings and lecture halls, respectively. The experiment was conducted in the chamber at University of Malaya instead of real buildings because it is difficult to get approval from the buildings' managements. The verification required the building's indoor air temperature adjusted from 23 - 27^{o}C and feedback from the occupants for every increment of the temperature. Such verification will influence their daily operation and therefore the managements do not allow the experiment to be conducted at their place. Hence, the verification has to be conducted at the chamber. However, since the adaptive models for hospitals, offices and lecture halls share the same verification purpose, which is to determine the occupant's thermal comfort vote in different combinations of indoor and outdoor temperatures, hence the same experiment could be applied for all these three types of buildings.

In parallel to the subjective measurements, the physical measurements on indoor air temperature, globe temperature, air velocity, relative humidity and outdoor temperature were taken simultaneously. Indoor air temperature, relative humidity and outdoor temperature were measured using the KIMO Temperature and Humidity Data Logger as shown in Table 3.1. The sampling times were set to 1 minute for the data logger.

On the other hand, the globe temperature and the air velocity were measured using TSI Alnor thermo Anemometer and KIMO Thermocouple thermometers after every one hour during the experiment period. At least 40 samples with sampling time of 30 seconds were taken during each measurement.

3.5 Summary

The details of the research method in the present work have been described in this chapter. The results and discussion for hospital field work will be elaborated in the next chapter.

Chapter 4 Results and Discussion – Field Work Study in Hospitals

Surveys were done in the nine hospitals with 41 departments in Kuala Lumpur, Malaysia in the years 2009 and 2010. A total number of 293 workers who took part in this survey were the workers on duty during the field measurement's period of about four hours for each department. On an average of 7 persons for each department, the questionnaires survey is sufficient for analysis. This is because in the real situation, the number of workers located in each department is less than 10 persons.

Besides that, the space or room size does not matter since most of the hospitals have a constant air volume (CAV) system in their air handling unit (AHU). In the CAV system, the supply air flow rate is constant and serves only a single thermal zone. Hence, no matter what is the room size, as long as the rooms share the same AHU, they will have the same supply air flow rate and air temperature.

The questionnaires have been distributed to the personnel on duty stay in the department for at least one hour. This is to ensure that they have an actual thermal perception on the current environment rather than mixing with the previous environment where he or she comes. The response rate was 100%, the ratio of respondents between male-female was 1:2.5 and the age groups was between 23 - 45 years old. The physical parameters and the results from the subjective measurement are shown in Tables 4.1 and 4.2, respectively. The details of all the measurements are shown in Appendix D.

Table 4.1 : Physical parameters measured and calculated in nine hospitals.

Hospital	Department	T_{air} (^oC)	T_{globe} (^oC)	V (m/s)	RH (%)	MRT (^oC)	T_{op} (^oC)
UMMC	Pharmacy	22.2	23.2	0.13	74.2	24.1	23.1
	Otorinolaringologi	22.7	22.7	0.07	76.2	22.7	22.7
	Oftalmologi	22.7	22.4	0.10	73.8	22.2	22.4
	Emergency Consultation Hall	21.0	22.5	0.11	73.1	23.7	22.3
	Observation ward	20.3	21.4	0.11	75.4	22.3	21.3
Putrajaya	Pediatric ward	24.1	24.1	0.06	64.4	24.1	24.1
	Orthopedic ward	23.3	23.2	0.11	56.7	23.1	23.2
	Female medical ward	23.3	25.6	0.07	53.7	27.0	25.1
	Pharmacy	22.5	22.5	0.15	65.3	22.5	22.5
	X-ray & radiography	21.3	21.3	0.20	68.4	21.3	21.3
	Out-patient pharmacy	22.2	22.2	0.16	53.1	22.2	22.2
	Day care unit	21.8	21.8	0.19	56.9	21.8	21.8
Sungai Buloh	Outpatient pharmacy	21.5	21.4	0.12	67.5	21.2	21.4
	Pathodology unit	21.6	21.8	0.12	70.4	22.0	21.8
	X-Ray workstation	22.6	21.9	0.11	68.9	21.3	22.0
	Pediatric ward	23.0	23.3	0.11	68.3	23.5	23.2
	Maternity ward	21.8	21.7	0.10	64.0	21.6	21.7
Selayang	Outpatient pharmacy	20.2	20.4	0.11	63.7	20.5	20.3
	Pediatric ward	23.5	23.7	0.13	61.1	23.9	23.7
	Maternity ward	25.4	25.6	0.20	56.3	25.8	25.6
	Pathodology unit	23.2	23.5	0.12	64.6	23.7	23.4
	X-ray workstation	21.5	21.7	0.12	67.8	21.8	21.6
Klang	Picture Archiving Communication	24.4	24.4	0.23	50.6	24.4	24.4
	Pathology	23.1	23.1	0.28	46.3	23.1	23.1
	X-ray & radiography	25.2	25.2	0.16	70.3	25.2	25.2
	Cytology laboratory	20.9	20.9	0.49	47.8	20.9	20.9
	Endoscopy	20.7	20.7	0.05	74.7	20.7	20.7
	Medical day care	22.2	22.2	0.06	71.3	22.2	22.2
Kajang	Clinic	25.4	25.4	0.17	52.4	25.4	25.4
	Haemodialisis	25.8	25.8	0.16	59.2	25.8	25.8
	Pharmacy	25.2	25.2	0.17	57.8	25.2	25.2
	X-ray & radiography	23.4	23.4	0.21	53.2	23.4	23.4
Private	Accident & Emergency ward	21.7	21.7	0.57	61.5	21.7	21.7
	Labor ward	22.4	22.4	0.44	67.2	22.4	22.4
	Delivery Suite	21.8	21.8	0.53	65.2	21.8	21.8
	Intensive Care Unit	22.7	22.7	0.41	72.8	22.7	22.7
Kuala Kubu	Hematologi lab	26.0	26.0	0.18	54.1	26.0	26.0
	Pharmacy	24.5	24.5	0.12	53.8	24.5	24.5

	X-Ray workstation	26.9	26.9	0.08	54.1	26.9	26.9
Banting	Pathology Unit	22.5	24.9	0.29	62.3	27.9	25.2
	Pharmacy	23.0	24.8	0.09	57.3	26.1	24.5

Table 4.2 : Subjective measurements of occupants in nine hospitals.

Hospital	Department	met	clo	AMV	APD (%)	PMV	PPD (%)
UMMC	Pharmacy	1.33	0.69	-0.75	25.0	0.12	5.0
	Otorinolaringologi ward	1.20	0.48	-0.65	30.0	-0.48	10.0
	Oftalmologi ward	1.08	0.52	-1.00	30.0	-0.75	17.0
	Emergency Consultation Hall	1.32	0.48	-0.90	10.0	-0.53	11.0
	Observation ward	1.26	0.42	-1.00	25.0	-0.89	22.0
Putrajaya	Pediatric ward	1.34	0.42	0.60	0.0	-0.04	5.0
	Orthopedic ward	1.25	0.44	-0.67	20.0	-0.33	7.0
	Female medical ward	1.23	0.43	-0.35	15.0	-0.01	5.0
	Pharmacy	1.30	0.61	-1.60	40.0	-0.25	6.0
	X-ray & radiography	1.28	0.79	-1.20	40.0	-0.29	7.0
	Out-patient pharmacy	1.36	0.67	-0.80	20.0	-0.11	5.0
	Day care unit	1.40	0.62	-1.50	25.0	-0.34	7.0
Sungai Buloh	Outpatient pharmacy	1.15	0.77	-0.10	45.0	-0.61	13.0
	Pathodology unit	1.70	0.80	0.10	10.0	0.55	11.0
	X-Ray workstation	1.40	1.34	0.10	5.0	0.79	18.0
	Pediatric ward	1.43	0.48	0.30	30.0	0.00	5.0
	Maternity ward	1.50	0.70	-0.20	25.0	0.17	6.0
Selayang	Outpatient pharmacy	1.40	1.37	-2.40	21.0	0.51	10.0
	Pediatric ward	1.43	0.48	-0.80	16.0	0.02	5.0
	Maternity ward	1.50	0.70	-0.40	28.8	0.80	19.0
	Pathodology unit	1.20	0.85	-1.20	14.0	0.27	7.0
	X-ray workstation	1.20	1.17	-1.70	11.0	0.29	7.0
Klang	Picture Archiving Communication	1.40	0.38	1.00	0.0	-0.27	6.0
	Pathology	1.40	0.62	-1.00	50.0	-0.20	6.0
	X-ray & radiography	1.50	0.54	0.33	33.3	0.65	14.0
	Cytology laboratory	1.50	0.75	-1.67	66.7	-0.47	10.0
	Endoscopy	1.60	0.42	1.50	75.0	-0.35	8.0
	Medical day care	1.36	0.51	0.77	33.0	-0.16	6.0
Kajang	Clinic	1.13	0.44	-1.33	33.3	-0.33	7.0
	Haemodialisis	1.40	0.60	0.00	0.0	0.70	15.0
	Pharmacy	1.55	0.44	1.00	0.0	0.41	8.0
	X-ray & radiography	1.40	0.66	-1.25	25.0	0.06	5.0
Private	Accident & Emergency ward	1.40	0.59	-2.00	50.0	-0.89	22.0

	Labor ward	1.70	0.38	-2.00	50.0	-0.53	11.0
	Delivery Suite	1.70	0.38	-1.00	33.3	-0.82	19.0
	Intensive Care Unit	1.40	0.40	-1.00	25.0	-0.94	24.0
Kuala Kubu	Hematologi lab	1.26	0.54	-1.40	40.0	0.47	10.0
	Pharmacy	1.18	0.52	0.08	15.4	-0.06	5.0
	X-Ray workstation	1.14	0.58	1.00	0.0	0.66	14.0
Banting	Pathology Unit	1.30	0.48	-0.71	28.6	-0.26	6.0
	Pharmacy	1.15	0.59	-1.00	0.0	-0.08	5.0

4.1 Behavioural adaptations

Behavioural adaptations are commonly represented by clothing insulation, activity level and air velocity as suggested by ASHRAE RP-884 (de Dear *et al.*, 1997).

4.1.1 Clothing insulation

The relationship between the clo value and both indoor operative temperature and outdoor temperature for the nine studied hospitals is shown in Figures 4.1 and 4.2 respectively.

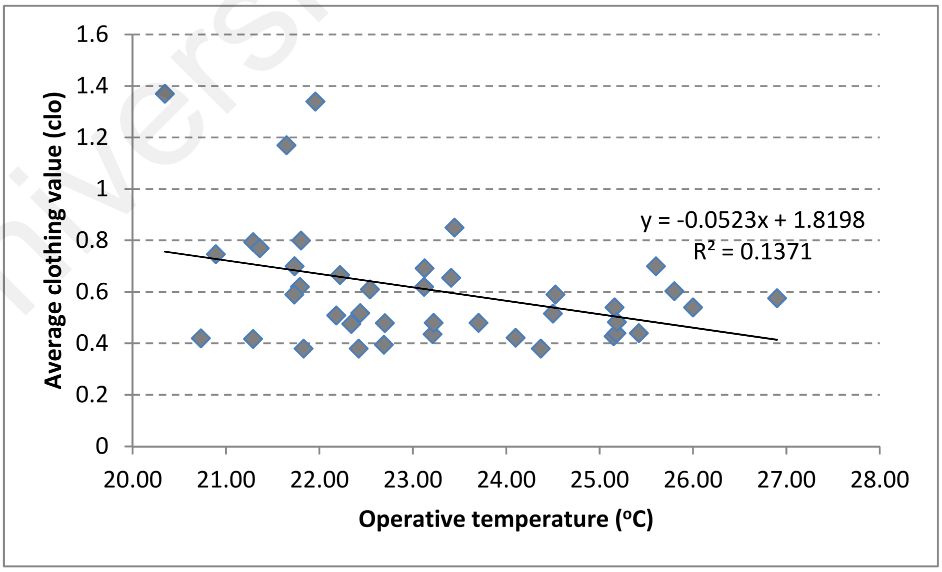

Figure 4.1 : Relationship between clothing insulation and indoor operative temperature.

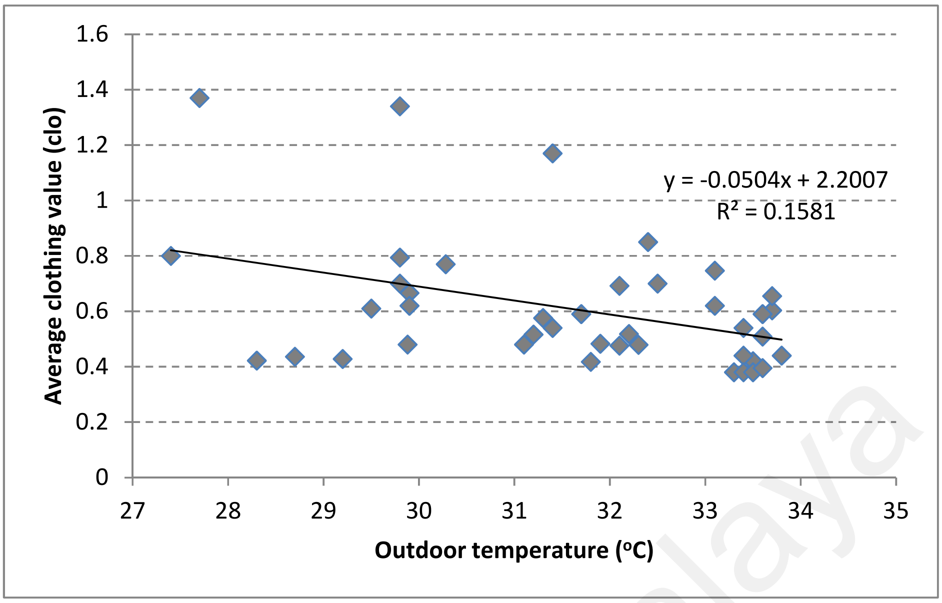

Figure 4.2 : Relationship between clothing insulation and outdoor temperature.

By referring to Figure 4.1, the correlation between the clothing insulation and the operative temperature for the hospitals in Malaysia is given by Equation (4.1).

$$Clo = -0.0523\ T_{op} + 1.8198 \qquad (4.1)$$

Other researchers have done a similar analysis, and their results are shown in Equations (2.2) to (2.4).

Note that Equations (2.2) to (2.4) has been developed for the HVAC buildings, air-conditioned offices and free running buildings respectively. These equations are used to compare the correlation found in the hospitals in hot and humid Malaysia, although there is a difference in the building type and climate context. This is because so far, there is no other similar study on the behavioural adaptations conducted in hospitals in hot and humid climates that can be used as a reference.

The difference between Equation (4.1) and both Equations (2.2) and (2.3) can be explained by the uniforms worn by the hospital workers in Malaysia. Generally, the hospital workers, mostly female nurses in Malaysia, wore a scarf on the head (the scarf is called tudung), which is one of the religion practices for the Malay females. The 'tudung' adds to the thermal insulation of the clothing, hence they will feel warmer compared to others without tudung. When the indoor operative temperature is increased by 1°C, the hospital workers in Malaysia will adjust their clothing by decreasing 0.052 clo compared to 0.04 clo in other countries.

Figure 4.2 shows the linear regression between the clothing value and the outdoor temperature for the hospitals in Malaysia. The correlation is given in Equation (4.2).

$$\text{Clo} = -0.0504\ T_{out} + 2.2007 \tag{4.2}$$

Researchers (Mui & Chan, 2003) have found the correlation for offices in Hong Kong as in Equation (2.5). The discrepancy between Equations (4.2) and (2.5) indicates that the people in Hong Kong and Malaysia show different thermal adaptations to the changes of weather in their countries.

4.1.2 Activity level

In Figure 4.3, it has been found that the regression line is almost horizontal with a maximum of 1.70 met, a minimum of 1.08 met and an average of 1.36 met. In this case, the average met is higher than 1.2 met found by other researchers such as (Bouden & Ghrab, 2005; de Dear & Brager, 1998; Mui & Chan, 2003) because the staffs are required to move around compared to the office workers, who are just doing sedentary work. Activities such as pushing patients' beds, trolleys and checking the blood pressure or other conditions of each patient in different rooms requires a higher metabolic rate. Figure 4.3 indicates clearly that the activity level is almost independent of the indoor operative temperature. The activity level should be the function of work performed by staff, especially in the hospitals, rather than depending on the operative temperature. In other words, a person's activity level should depend on his or her job requirement itself rather than the ambient temperature.

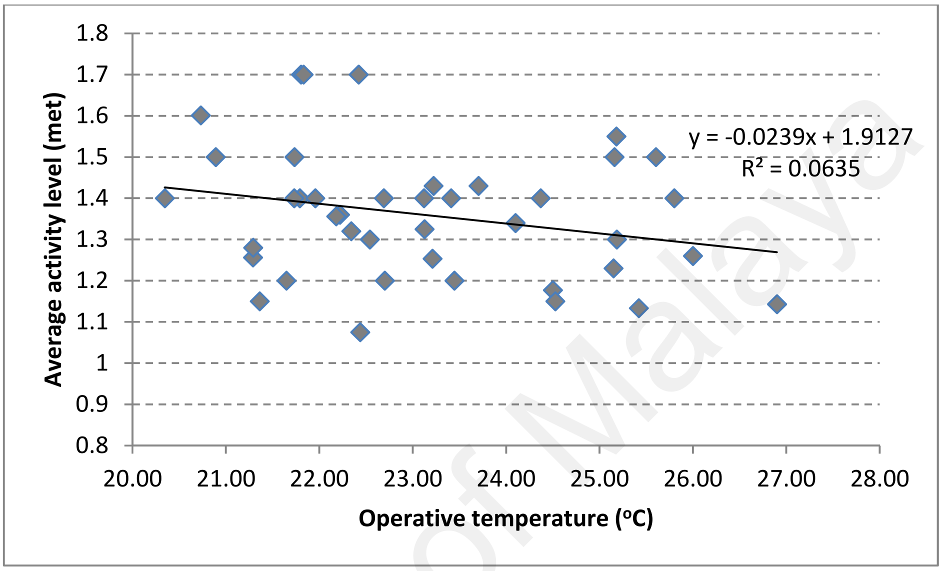

Figure 4.3 : Relationship between activity level and operative temperature.

4.1.3 Air velocity

Figure 4.4 shows the linear regression between the indoor air velocity and the operative temperature in the hospitals and is depicted in Equation (4.3).

$$V = -0.0127\ T_{op} + 0.4747 \tag{4.3}$$

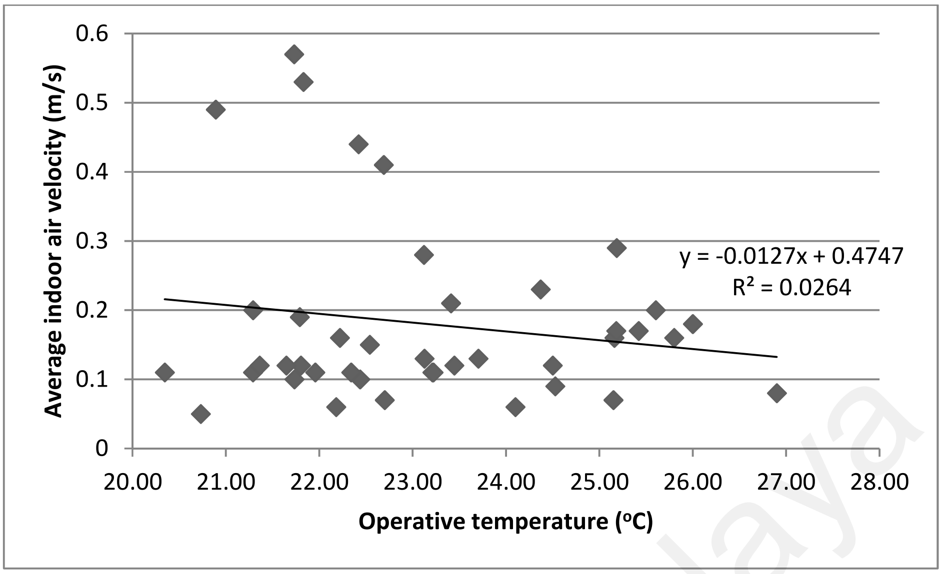

Figure 4.4 : Relationship between indoor air velocity and operative temperature.

Note that the slope found in this study was a negative slope, but the slope found by de Dear & Brager (1998) and Mui & Chan (2003) in Equations (2.6) and (2.7) are a positive slope. According to the ASHRAE Standard 55 (2004), occupants will prefer a higher air speed at a higher operative temperature. However, from the results obtained in Figure 4.4, it shows that the air speed is decreasing with an increasing operative temperature. This contrary condition is due to the centralized air-conditioning system in the hospitals where the air speed is not locally controlled by the workers. In this case, the air speed is dependent on the air flow from the diffusers. A higher indoor air temperature comes from a lower air flow from the diffuser. From the theory (Flow Rate = Cross Sectional Area x Velocity), a lower flow rate will give a lower air velocity. Hence, as depicted in Figure 4.4, the higher the indoor operative temperature, the lower the air velocity will be attained. This condition indicates that the workers in hospitals do not achieve thermal comfort without a local control on the air velocity.

4.2 Thermal acceptability

The correlation between the percentage dissatisfied and the operative temperature is shown in Figure 4.5. In order to obtain an actual percentage dissatisfied (APD) below 20% as recommended by the ASHRAE Fundamentals Handbook (2009), the operative temperature range set to be 23.7-27.7°C. The temperature range to keep the predicted percentage dissatisfied (PPD) below 20% is 19.2-28.5°C. From Figure 4.5, the wide temperature range for 20% PPD shows that the Fanger's model has a higher prediction for the human adaptation ability to the changes in the surrounding temperature.

In contrast, the occupants in Malaysia showed a narrower thermal acceptance of 23.7-27.7°C compared to the predicted value of 19.2-28.5°C when using the Fanger's model. The temperature range determined from the 20% PPD was not suitable to be applied locally. This is because Malaysians are used to the hot and humid climate all year round, thus they will find 19.2°C to be a cold environment. Hence, the temperature range of 23.7-27.7°C found from the 20% APD is acceptable and applicable to the hospitals in Malaysia.

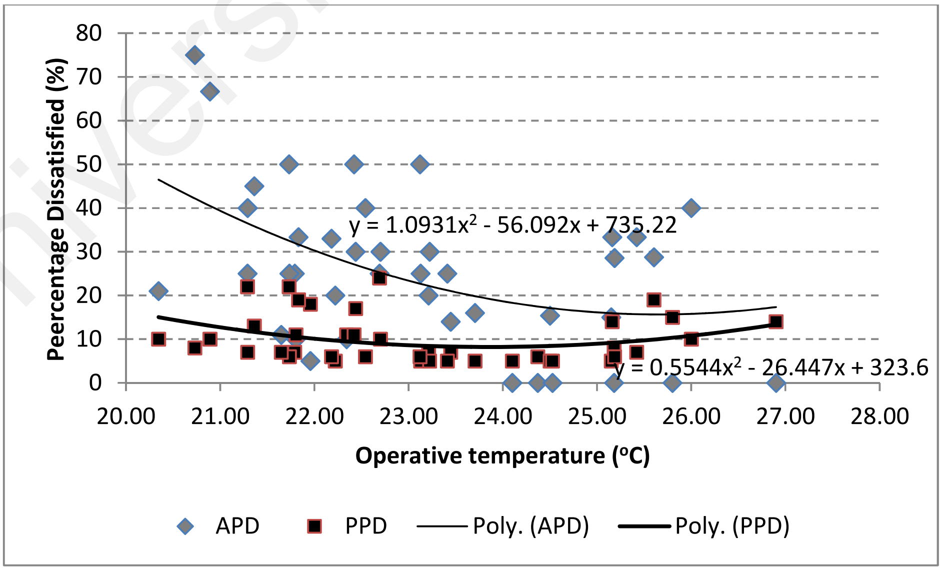

Figure 4.5 : Graph of percentage dissatisfied versus operative temperature.

4.3 Thermal neutrality

Thermal neutrality is the operative temperature at the mean thermal sensation vote of zero. From Figure 4.6, the neutral temperature for the predicted mean vote and the actual mean vote were 23.8°C and 26.4°C, respectively. The difference of 2.6°C between the PMV and AMV was a significant value, and this implies that in the actual case, the hospital workers in Malaysia prefer a warmer indoor environment compared to the predicted environment from the Fanger's model. This finding is important for the local HVAC design engineers, since increasing the setting of people's comfort temperatures in an air-conditioning system by 2.6°C could save a significant amount of energy consumed in a building.

In the hospitals, the field study has been conducted at the staff working area such as nurse counter or personnel room. Thus, the recommended neutral temperature is specifically for the staff working area instead of patient's bed area. In practical, it is suggested to install a Variable Air Volume (VAV) system to serve multiple thermal zones to patients and workers area. The VAV system is important to ensure that both workers and patients can achieve their own thermal comfort level.

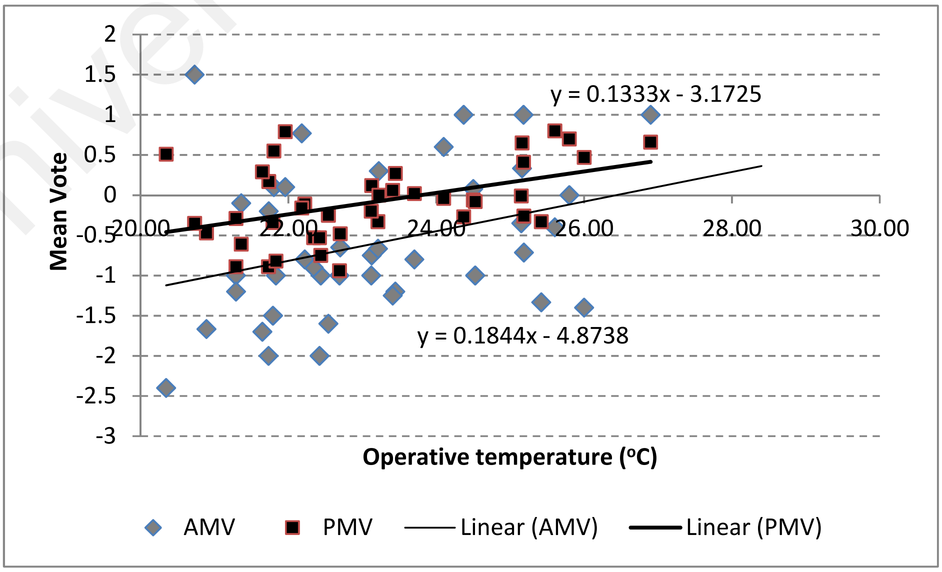

Figure 4.6 : Graph of mean thermal sensation vote versus operative temperature.

4.4 Adaptive Thermal Comfort Model

In the last decades, many researchers have developed adaptive thermal comfort models for different countries with different climates. In order to develop an adaptive thermal comfort model, the relationship between the indoor neutral temperature and the outdoor temperature must be determined. Table 4.3 shows the neutral temperature and the outdoor temperature collected from the survey in nine hospital buildings.

Note that the neutral temperature in Table 4.3 is determined from the vote of zero in the correlation between the actual mean vote and the operative temperature for each hospital. The details are shown in Appendix E. In the correlation analysis, the neutral temperature obtained is based on a group preference instead of individual preferences. This is because according to ASHRAE Fundamentals Handbook (2009), a space or room is considered comfortable when there are 80% of the occupants feel satisfied with the environment. Hence, in this condition, a group preference is more practical than individual preferences.

On the other hand, the outdoor temperature is the mean value collected during the field measurement for each hospital. The outdoor temperature was recorded every 15 minutes during the field measurement.

Table 4.3 : Neutral temperature and outdoor temperature of nine hospitals.

Hospital	T_n (°C)	T_{out} (°C)
UMMC	27.8	32.1
Putrajaya	24.9	29.3
Sungai Buloh	21.8	29.4
Selayang	26.4	31.0
Klang	21.2	33.3
Kajang	25.8	33.7
Private	27.4	33.5
Kuala Kubu	26.2	31.3
Banting	26.8	31.8

By plotting the field survey data shown in Table 4.3, a linear regression model was generated, as shown in Figure 4.7 and Equation (4.4).

$$T_n = 0.3314\ T_{out} + 14.858 \qquad R^2 = 0.0535 \qquad (4.4)$$

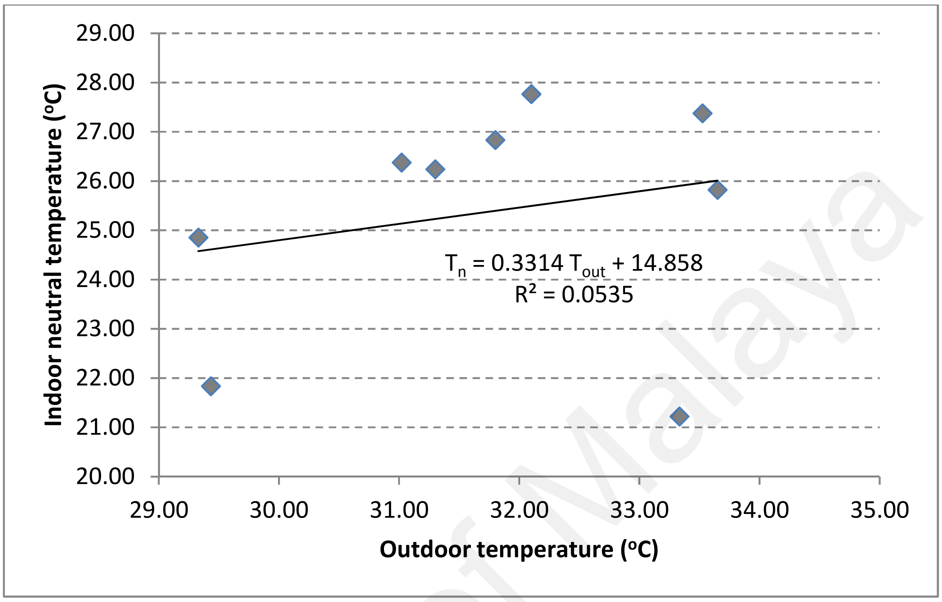

Figure 4.7 : Adaptive thermal comfort model for hospital buildings in hot and humid Malaysia.

Note that the indoor neutral temperature increases by about 1°C for a 3°C increment in the outdoor temperature. According to the findings from Mui & Chan (2003) in the humid, sub-tropical Hong Kong, the neutral temperature increases by about 1°C for every 6°C increase in the outdoor temperature. The difference between these results shows that different climates will result in a different thermal sensation. A number of field studies also found that the neutral temperature varies with the climate or season (Cena & de Dear, 2001). Generally, occupants in warmer climates tend to demonstrate warmer thermal neutrality (de Dear & Brager, 1998).

From the adaptive model as in Equation (4.4), the slope of the linear regression is very similar to Equations (2.9), (2.13) and (2.14) (Auliciems & de Dear, 1986; Nicol, 1995; Nicol *et al.*, 1999). However, the constant of Equation (4.4) is different from the other researchers as shown in Equations (2.8) to (2.17). Furthermore, the R-squared value of Equation (4.4) is very small compared to the unity, and this questions the appropriateness of the model. Residual analysis is carried out to check the appropriateness of the adaptive thermal comfort model. The calculation of the residual analysis is shown in Appendix F. In Figure 4.8, the residual plots behave randomly and this shows that the adaptive model in Equation (4.4) provides a decent fit to the data. Hence, a linear regression model is appropriate for the data.

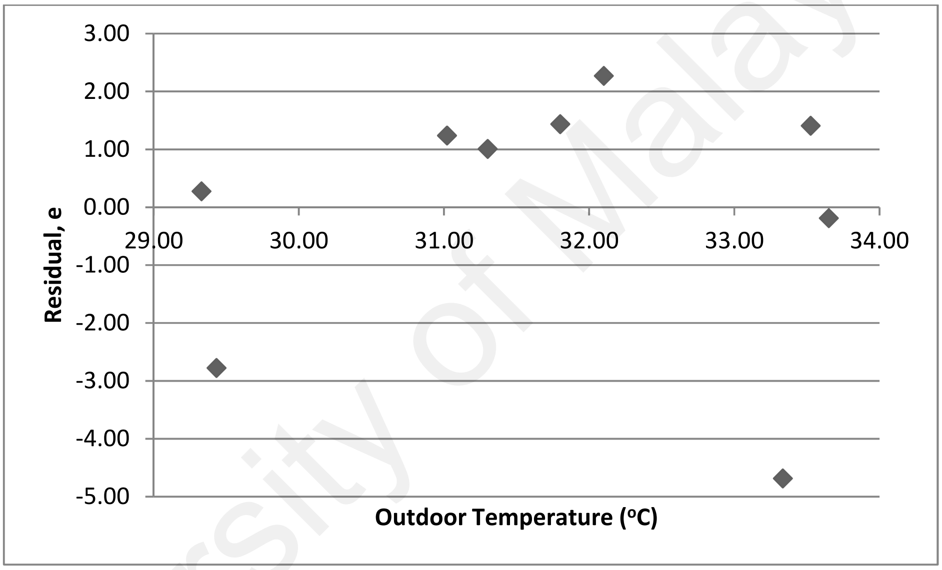

Figure 4.8 : Residual plots.

To further investigate the reliability of the adaptive model, a T-test was carried out, comparing the response variable and the fitted value in Appendix F. The Paired T-test statistical analysis was performed using the mathematics software program SPSS Statistics 20. The results of the Paired T-test are shown in Table 4.4. The results show that the mean of the response variable minus the fitted value equals -0.00111, and it fell within the 95% confidence interval between -1.75031 to 1.74809. Besides that, the significance value is 0.999. If the significance value is smaller than 0.05, there is a significant difference. If the significance value is larger than 0.05, there is no significant difference. Note that the significance value calculated in Table 4.4 is larger than 0.05, thus there is no significant difference between the response variable and the fitted value from a statistical point of view. Therefore, the null hypothesis is true and cannot be rejected. It indicates that the adaptive model proposed is reliable and applicable for hospitals in hot and humid Malaysia.

Table 4.4 : Results of Paired T-test by SPSS Statistics 20.

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	**Std. Deviation**	**Std. Error Mean**	**Lower**	**Upper**	**t**	**df**	**Sig. (2-tailed)**
Pair	Response variable-Fitted value	-0.00111	2.27563	0.75854	-1.75031	1.74809	-0.001	8	0.999

On the other hand, in order to check the validity of the field measurement data, the bias uncertainty analysis is applied here. According to Yau (2004), in error analysis, the bias uncertainty (B.U.) for the measurement parameters can be approximately represented by Equation (4.5).

$$B.U = (X_{max} - X_{min}) / n \qquad (4.5)$$

where

X = measurement parameters such as air velocity, air temperature, globe temperature, relative humidity and outdoor temperature.

n = number of readings

X_{max}, X_{min} = maximum and minimum value of the measured parameters.

A set of data is considered valid for use if the error for the bias uncertainty is less than 10% (Yau, 2004). After calculation, the five basic parameters in this study, which are V, T_{air}, T_{globe}, RH and T_{out}, are all below 10% error bias uncertainty (as shown in Appendix G). Thus, the measured parameters are all valid to be used in determining the adaptive thermal comfort model.

Note that the error analysis for the air velocity is much higher compared to that of the other parameters. The highest value recorded is 9.84% uncertainty for the air velocity. This is because an accurate measurement of a low air velocity is difficult (Melikov *et al.*, 2007). Also, a more reliable sensor reading is possible only if the air velocity is more than 2 m/s (Thomas *et al.*, 1998). Nevertheless, the bias uncertainty error for the air velocity is still less than 10% and thus at an acceptable level.

4.4.1 Upper and lower limits of the adaptive model

In order to obtain an adaptive thermal comfort model that is suitable for application in the hospitals in Malaysia, a calibration to determine the upper and lower limits of the model is needed. According to the ASHRAE Fundamentals Handbook (2009), a comfort zone is when 80% of the occupants find the environment are thermally acceptable. In other words, a comfort or neutral zone is a zone of maximum allowable of 20% occupants' dissatisfaction.

In Figure 4.9, for a maximum of 20% actual percentage dissatisfied (APD), the range for the indoor neutral temperature is 23.3 - 26.5^{o}C. The outdoor temperature range is 25.4 - 35.0^{o}C as shown in Figure 4.10. If the outdoor temperature is lower than 25.4^{o}C, the recommended indoor neutral temperature will be constant at 23.3^{o}C. In turn, when the outdoor temperature is higher than 35.0^{o}C, the recommended indoor neutral temperature will be constant at 26.5^{o}C.

The adaptive thermal comfort model in combination with the upper and lower limits is important as a good guide to the local mechanical engineers, especially in the consulting firms. In designing HVAC system, this model can help to reduce the energy consumption as well as to achieve a high level of thermal comfort for the hospital workers in the tropics.

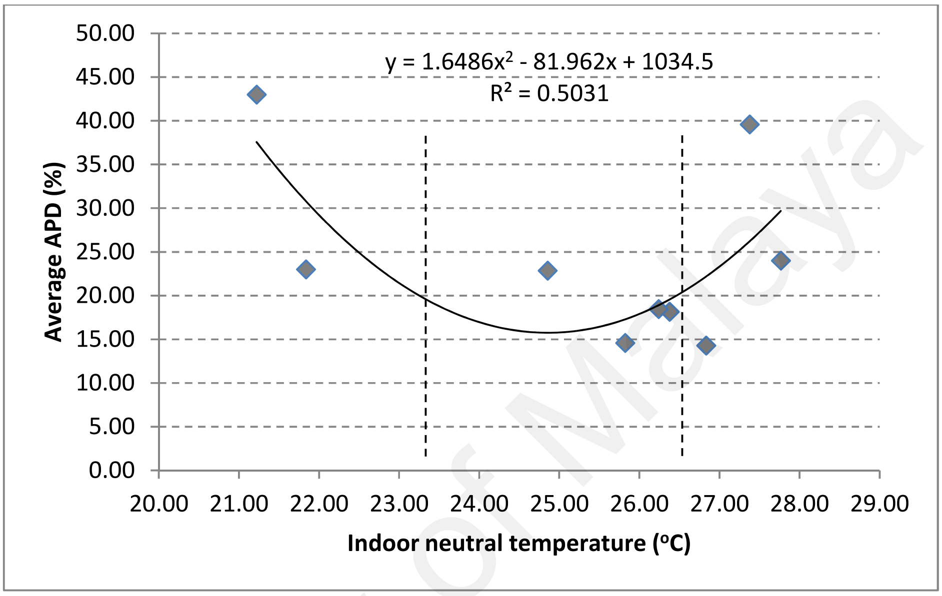

Figure 4.9 : Graph of APD versus indoor neutral temperature.

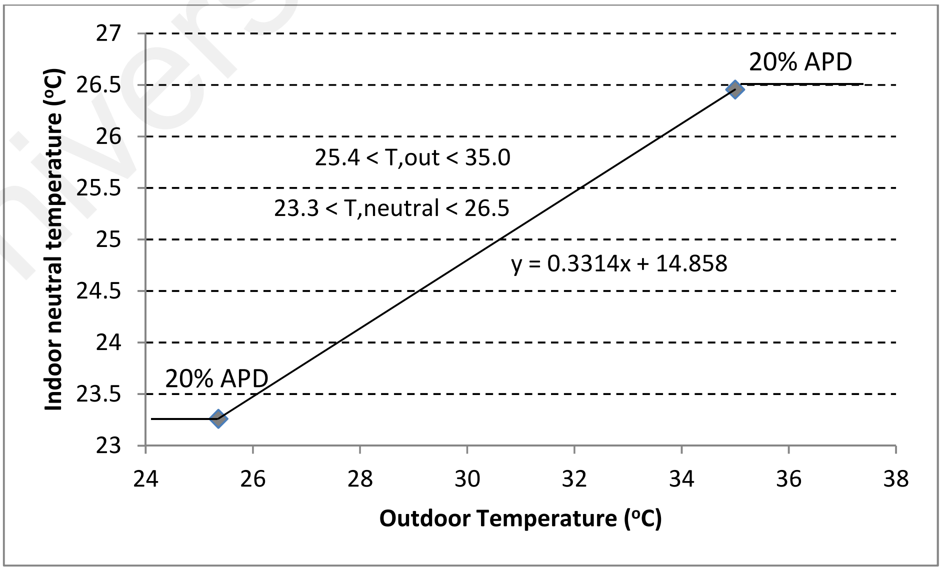

Figure 4.10 : Upper and lower limits of adaptive thermal comfort model.

4.4.2 Verification of the proposed adaptive model

The methodology for the verification of the adaptive model is shown in Chapter 3.4. The measurements collected during the experiment in a chamber are shown in Table 4.5. From the results in Table 4.5, a graph of actual mean votes versus indoor operative temperature was plotted in Figure 4.11. Figure 4.11 shows that the indoor neutral temperature collected during the experiment was 24.73°C.

In contrast, by using the adaptive model proposed in Equation (4.4), the neutral temperature calculated was 25.07°C at an average outdoor temperature of 30.83°C. The difference between the neutral temperature calculated using the adaptive model and the neutral temperature measured during the experiment was 0.34°C or 1.36 %. This discrepancy is due to the difference of clothing values and activity levels between the hospitals and the experimental chamber.

For the hospitals, the average clothing value and activity level were 0.61 clo and 1.36 met, respectively. For the chamber, the average value was 0.41 clo and 1.14 met. The hospital workers had a higher clothing value and metabolic rate because they use lab coats and are moving around the ward to monitor the patients or carry out their nursing work. This implies that people with different clothing insulation and activity level will have a different feeling on their thermal comfort level. Since the discrepancy is only 1.36 % as mentioned above, the adaptive model proposed in this thesis is valid for use in Malaysian hospitals.

Table 4.5 : Measurements during experiment in a chamber.

T_{air} (°C)	T_{globe} (°C)	V (m/s)	RH (%)	MRT (°C)	T_{op} (°C)	AMV	T_{out} (°C)
22.74	23.00	0.08	68.32	23.17	22.96	-1.70	30.46
22.90	22.90	0.11	69.07	22.90	22.90	-0.40	32.32
24.18	24.50	0.05	70.29	24.67	24.42	0	29.09
24.25	24.40	0.06	71.44	24.49	24.37	-0.30	30.99
24.66	24.50	0.07	70.58	24.40	24.53	-0.10	32.43
24.96	24.90	0.11	70.28	24.86	24.91	-0.10	31.27
26.28	26.20	0.06	75.34	26.16	26.22	0.50	31.00
26.37	27.50	0.09	72.55	28.27	27.32	1.55	32.00
26.42	26.50	0.14	79.99	26.57	26.49	1.10	29.52
27.27	26.20	0.10	69.84	25.42	26.34	1.30	29.23

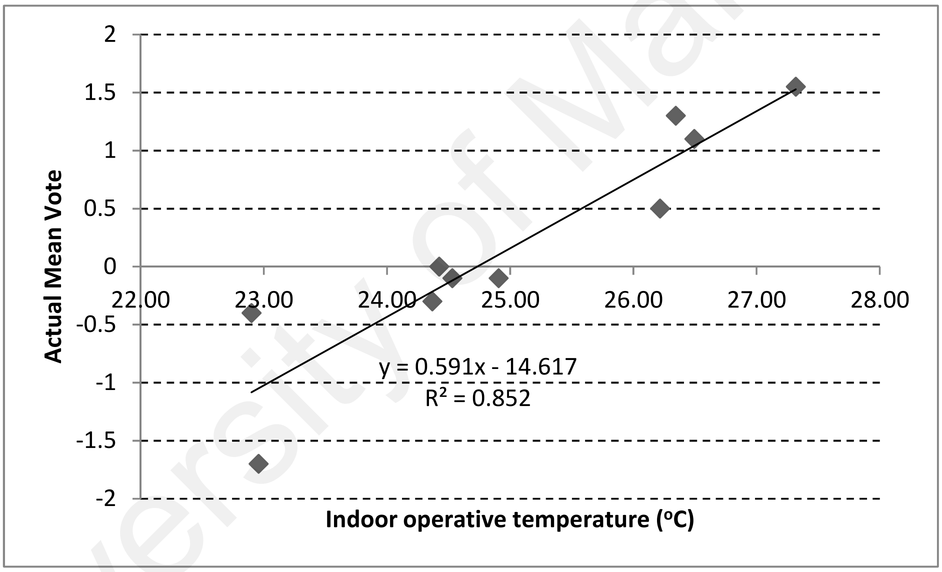

Figure 4.11 : Actual mean vote versus indoor operative temperature in a chamber.

4.5 Summary

In this study, the relationship between the operative temperature and the clothing insulation, the metabolic rate and the air velocity was successfully established. The adaptive thermal comfort model for hot and humid climates such as Malaysia was also successfully developed based on the linear relation between the indoor and outdoor air temperatures.

The adaptive model that has been developed in this research is T_n = 0.3314 T_{out} + 14.858, with its upper and lower limits of 23.3 - 26.5°C for the indoor neutral temperature and 25.4 - 35.0°C for the outdoor temperature, respectively. This model is suitable for use in the hospitals in Malaysia since the error is only 1.36 % between the neutral temperatures calculated using the aforementioned equation and the neutral temperature measured from the experimental study in a chamber.

The most comfortable or neutral temperature found from the field study in the hospitals was 26.4°C. In comparison to the recommended temperature of 24.0°C by the ASHRAE Applications (2007), the proposed neutral temperature for the hospitals in this study is 2.4°C higher. This difference of 2.4°C has a significant impact on the energy saving potential of a building, because by increasing the room temperature setting from 24.0°C to 26.4°C, one could decrease the cooling load and thus save a significant amount of energy.

The next chapter will elaborate the results and discussion for the field work study in office buildings.

Chapter 5 Results and Discussion– Field Work Study in Office Buildings

Surveys were done in seven office buildings with 19 departments in Kuala Lumpur, Malaysia in the years 2009 and 2010. The total number of occupants who took part in the subjective measurements was 322 people. The field measurements took about four hours for each office level or department. The questionnaires were given to all the staffs on duty during the field measurements and the response rate was 100%. The ratio of respondents between the male-female was 1:1.16 and the age groups were between 19 - 55 years old. The physical parameters and the results from the subjective measurements are shown in Tables 5.1 and 5.2, respectively. The detail measurements are shown in Appendix H.

Table 5.1 : Physical parameters measured and calculated in seven office buildings.

Office	Level/Department	T_{air} (°C)	T_{globe} (°C)	V (m/s)	RH (%)	MRT (°C)	T_{op} (°C)
A	Level 1	26.0	23.9	0.02	58.1	23.2	24.6
	Level 2	26.4	24.3	0.03	60.5	23.4	24.9
B	Level 8	21.7	22.8	0.10	52.0	23.6	22.7
	Level 14	20.8	22.7	0.09	53.3	24.0	22.4
	Level 17	22.0	22.7	0.08	62.1	23.2	22.6
	Level 21	22.7	23.7	0.07	60.2	24.3	23.5
C	Ground Floor	24.4	25.8	0.09	48.9	26.7	25.6
	Level 1	23.2	25.6	0.09	44.2	27.2	25.2
D	Level 2	24.2	24.2	0.04	53.0	24.2	24.2
	Level 4	23.9	23.9	0.03	52.9	23.9	23.9
E	Human Resource Department	22.9	24.1	0.05	61.9	24.8	23.9
	Corporate Department	22.7	23.4	0.03	60.7	23.6	23.2
F	Level 1	20.2	21.4	0.09	55.8	22.3	21.3
	Ground Floor	23.4	23.4	0.09	62.0	23.4	23.4
G	Level 19, Tower 1	23.9	24.0	0.15	57.8	24.0	23.9
	Level 20, Tower 1	23.1	23.6	0.18	60.0	24.1	23.6
	Level 10, Tower 2	23.2	23.7	0.09	59.2	24.0	23.6
	Level 15, Tower 2	23.3	23.0	0.08	59.0	22.8	23.1
	Level 26, Tower 2	21.2	21.5	0.11	62.3	21.7	21.5

Table 5.2 : Subjective measurements of occupants in seven office buildings.

Office	Level/Department	met	clo	AMV	APD (%)	PMV	PPD (%)
A	Level 1	1.10	0.48	0.70	40.0	-0.19	6.0
	Level 2	1.06	0.46	1.00	35.7	-0.13	5.0
B	Level 8	1.12	0.43	-0.68	16.0	-1.14	32.0
	Level 14	1.06	0.51	-0.91	54.5	-1.02	27.0
	Level 17	1.09	0.55	-0.57	17.4	-0.75	17.0
	Level 21	1.13	0.41	-0.17	0.0	-0.82	19.0
C	Ground Floor	1.11	0.80	0.45	18.2	0.51	10.0
	Level 1	1.17	0.72	0.30	3.0	0.42	9.0
D	Level 2	1.42	0.43	-0.17	16.7	0.12	5.0
	Level 4	1.21	0.60	-0.20	10.0	0.01	5.0
E	Human Resource Department	1.38	0.43	-0.42	16.7	0.05	5.0
	Corporate Department	1.21	0.52	-0.56	25.0	-0.34	7.0
F	Level 1	1.31	0.54	-1.71	64.7	-0.68	15.0
	Ground Floor	1.25	0.51	-0.81	27.8	-0.08	5.0
G	Level 19, Tower 1	1.65	0.47	0.83	16.7	0.31	7.0
	Level 20, Tower 1	1.21	0.52	-1.30	39.1	-0.49	10.0
	Level 10, Tower 2	1.55	0.39	0.25	0.0	0.08	5.0
	Level 15, Tower 2	1.08	0.48	-0.32	10.5	-0.75	17.0
	Level 26, Tower 2	1.25	0.39	-1.25	41.7	-0.93	23.0

5.1 Behavioural adaptations

The following sub-sections describe the behavioural adaptations. Note that the behavioural adaptations are commonly represented by the clothing insulation, activity level and air velocity.

5.1.1 Clothing insulation

The relationship between the clo value and both the indoor operative temperature and outdoor temperature are shown in Figures 5.1 and 5.2, respectively.

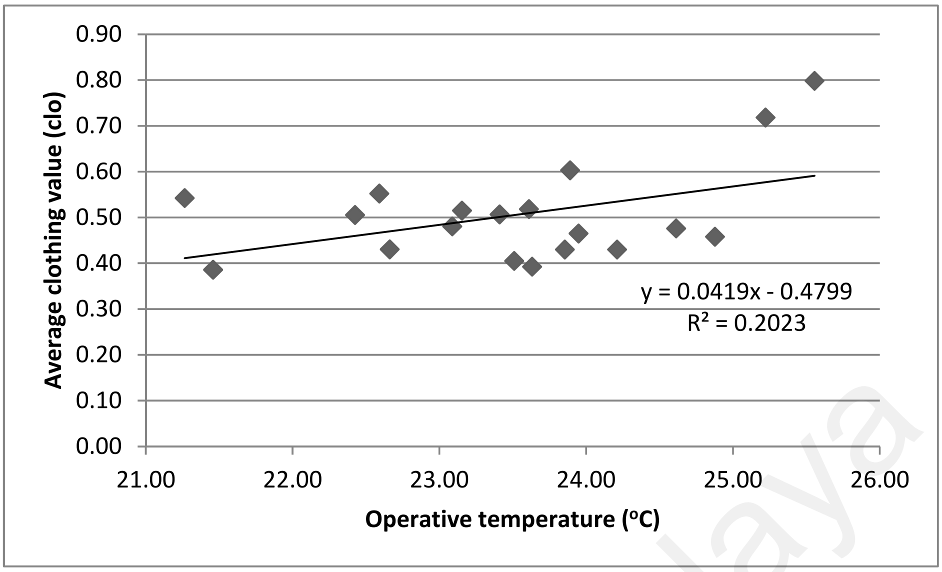

Figure 5.1 : Relationship between clothing insulation and indoor operative temperature.

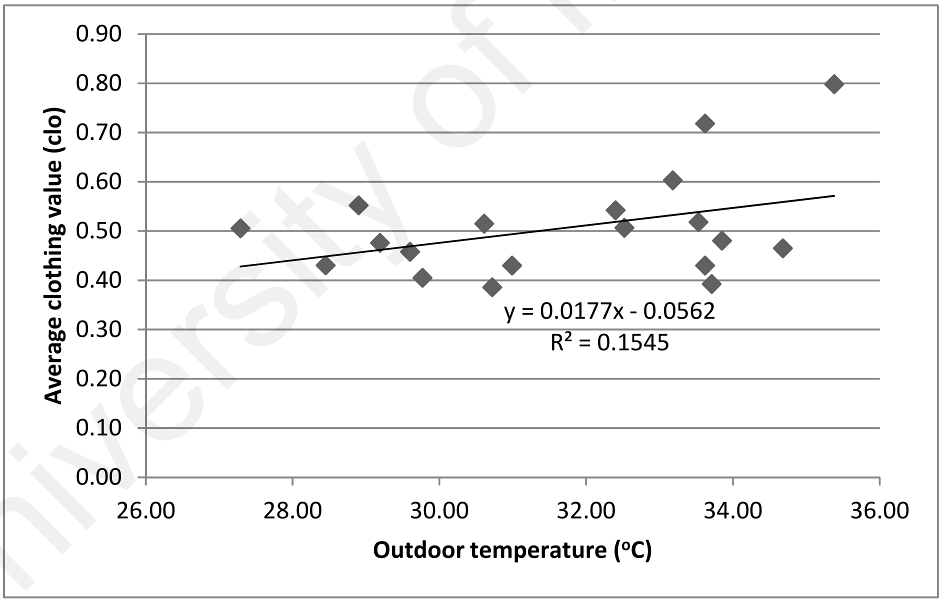

Figure 5.2 : Relationship between clothing insulation and outdoor temperature.

The correlation between the clothing insulation and the operative temperature for office buildings in Malaysia is given by Equation (5.1).

$$Clo = 0.0419\ T_{op} - 0.4799 \tag{5.1}$$

Other researchers had carried out similar analyses, and their results are shown in Equations (2.2) to (2.4). The slope of Equation (5.1) is opposite to those in Equations (2.2) to (2.4). From Figure 5.1, it can be seen that the positive slope of the linear regression is due to the high clo value of 0.80 and 0.72 clo from the Office C. The management of the Office C requires its entire staff to wear a company jacket during their working hours. This is the reason for the high clo value in this building.

Since the Office C has a special requirement on the occupants' attire, thus the clo value of the Office C should be eliminated from the other buildings' clo values. Note that the other office buildings possess a very similar range of clothing values. The new linear regression after ignoring the clo value of Office C is shown in Figure 5.3. The linear correlation in Figure 5.3 is almost horizontal with a small negative slope. Hence, it can be concluded that for the office buildings in Malaysia, the clothing value of occupants is almost independent of the indoor operative temperature.

Figure 5.2 shows the linear regression between the clothing value and the outdoor temperature. The correlation is given in Equation (5.2).

$$Clo = 0.0177\ T_{out} - 0.0562 \quad (5.2)$$

By performing the same elimination of the clo value from Office C as mentioned above, the new linear regression is as shown in Figure 5.4. The horizontal line shows that the occupants' clothing insulation is also independent of the outdoor temperatures in Malaysia. This indicates that the office workers choose their daily attire without considering either the indoor or outdoor temperatures during their working days.

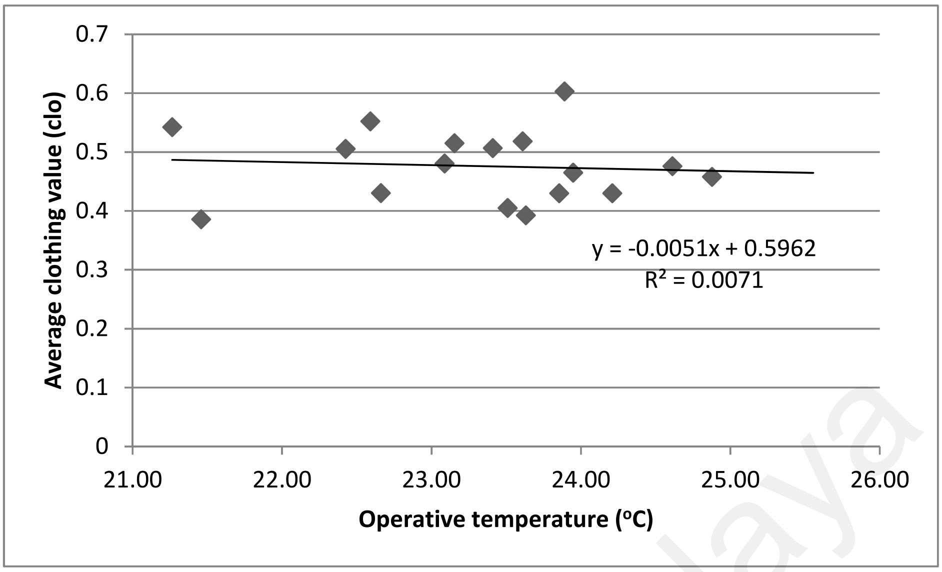

Figure 5.3 : New relationships between clothing insulation and indoor operative temperature.

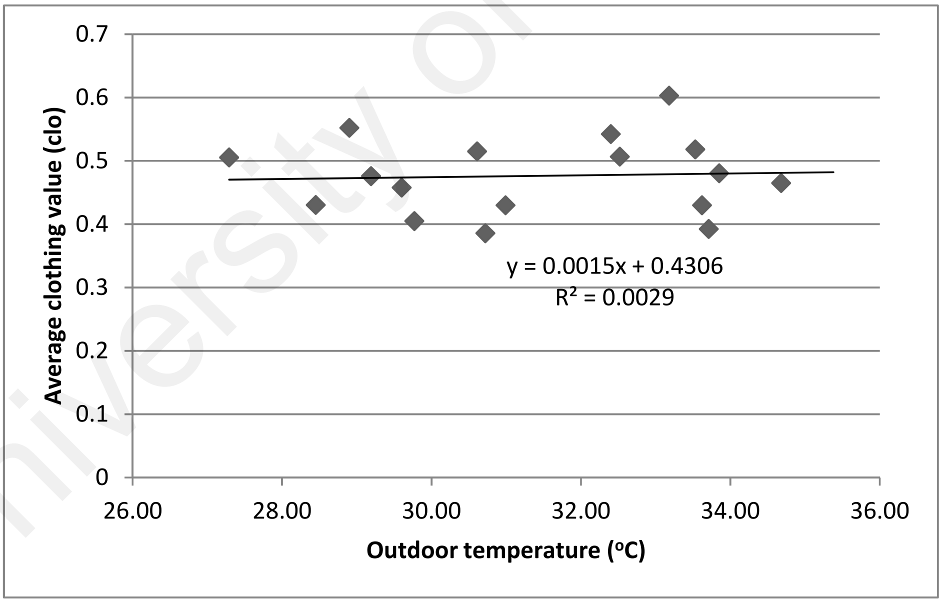

Figure 5.4 : New relationships between clothing insulation and outdoor temperature.

5.1.2 Activity level

The activity level of the occupants is measured in metabolic rate. In Figure 5.5, it is found that the regression line is horizontal with a maximum of 1.65 met, a minimum of 1.06 met and an average of 1.23 met. In this case, the average met is approximately the same as the 1.2 met found by different researchers (Bouden & Ghrab, 2005; de Dear & Brager, 1998; Mui & Chan, 2003). Also, the horizontal line in Figure 5.5 shows that the activity level of the occupants in office buildings is independent of the indoor operative temperature. The activity level for all the office occupants is more or less the same, where most of them are doing sedentary work no matter what the ambient temperature is.

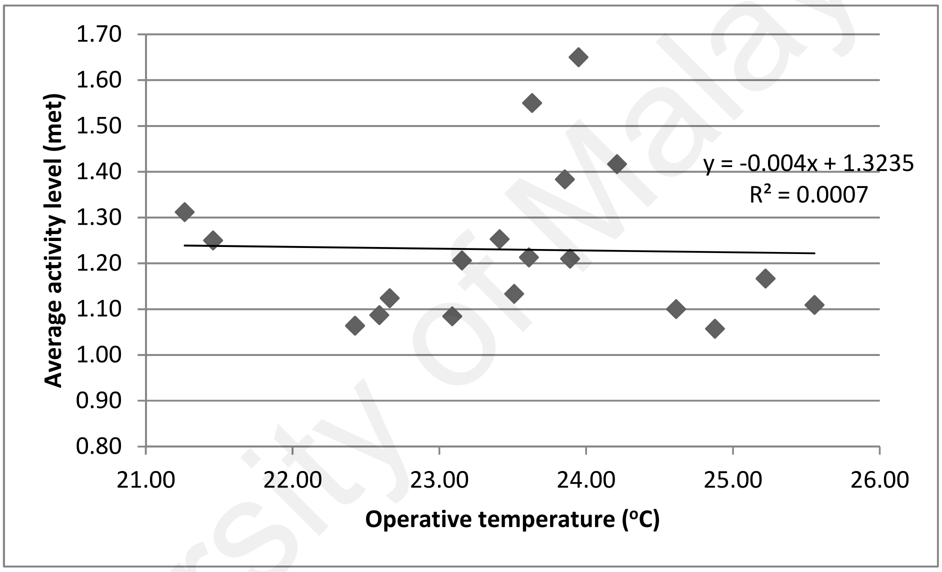

Figure 5.5 : Relationship between activity level and operative temperature.

5.1.3 Air velocity

Figure 5.6 shows the linear regression between indoor air velocity and operative temperature by the equation as shown in Equation (5.3).

$$V = -0.0088\, T_{op} + 0.2872 \quad (5.3)$$

Note that the slope found in this study is negative, but the slope found by de Dear & Brager (1998) and Mui & Chan (2003) in Equations (2.6) and (2.7) are positive. This result is similar to the results obtained in the hospitals in Chapter 4. Since the office buildings were also using the centralized air-conditioning system, where the air velocity was not under the occupants' local control, thus, as depicted in Figure 5.6, the higher the indoor operative temperature, the lower the air velocity attained. Notes that the air velocity values measured in this study are all within the limits of 0.2 m/s, as prescribed in the ASHRAE Standard 55 (2004).

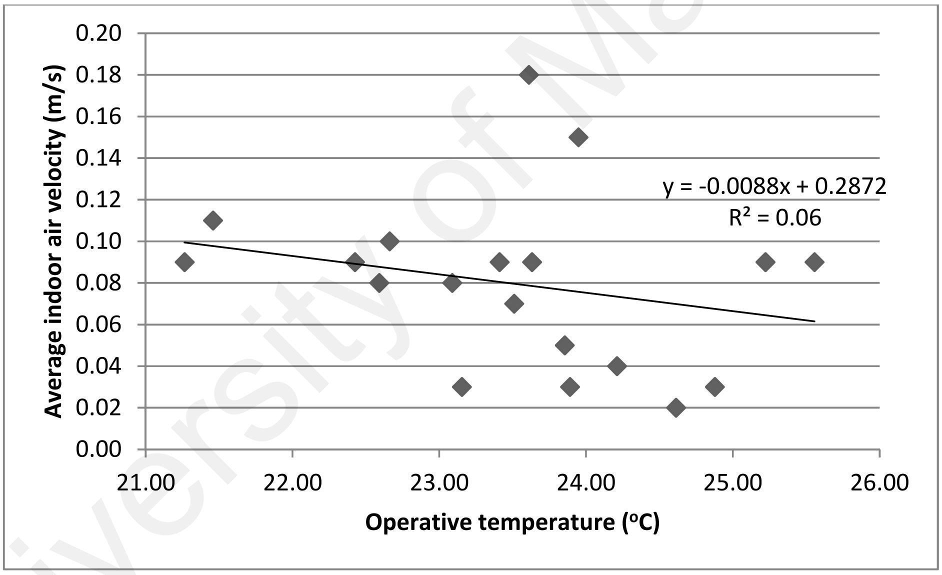

Figure 5.6 : Relationship between indoor air velocity and operative temperature.

5.2 Thermal acceptability

The correlation between the percentage dissatisfied and the operative temperature is shown in Figure 5.7. In order to obtain an actual percentage dissatisfied (APD) below 20% as recommended by the ASHRAE Fundamentals Handbook (2009), the operative temperature range must be within 23.3-25.2°C as shown in Figure 5.7. The temperature range to keep the predicted percentage dissatisfied (PPD) below 20% is 21.9-32.0°C. The wide temperature range for 20% PPD shows that the Fanger's model has a higher prediction for the human adaptation ability to change depending on the surrounding temperature.

The occupants in Malaysia showed a narrower thermal acceptance range of 23.3-25.2°C compared to the predicted value of 21.9-32.0°C when using Fanger's model. The temperature range from a maximum of 20% APD was acceptable because in the present thesis, the study focused on the air-conditioned office buildings. In contrast, for a maximum of 20% PPD, the temperature range is too wide and is not practically relevant because it is impossible to have an operative temperature of 32.0°C in an air-conditioned space in Malaysia. Occupants will find 32 °C to be too hot an environment and thermally discomfort for an air-conditioned space. Generally, the outdoor temperature in Malaysia ranges from 27 to 36 °C during a sunny day.

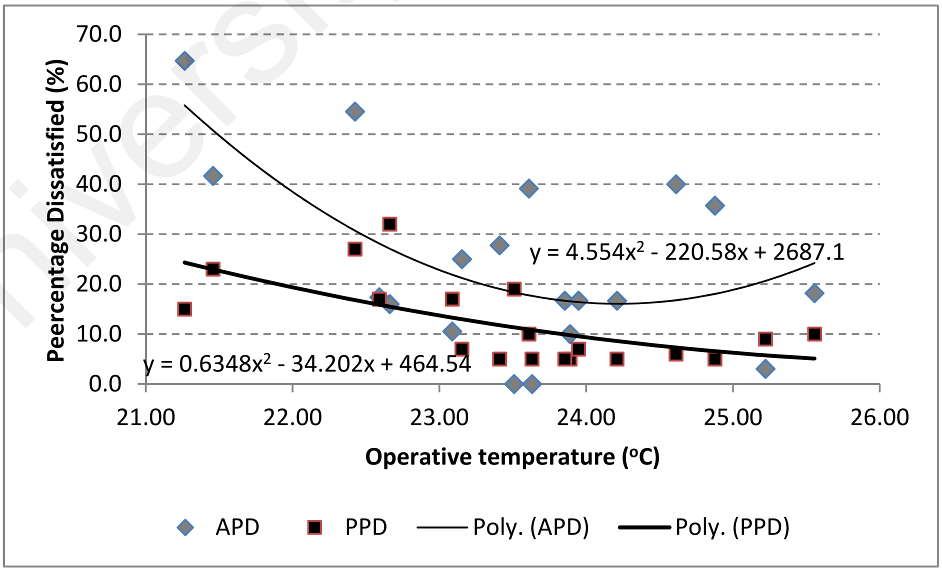

Figure 5.7 : Graph of percentage dissatisfied versus operative temperature.

5.3 Thermal neutrality

Thermal neutrality is the operative temperature at the mean thermal sensation vote of zero. From Figure 5.8, the neutral temperature for the predicted mean vote and the actual mean vote were 24.4°C and 24.1°C, respectively. This implies that in the real environment, the office occupants in Malaysia prefer a slightly cooler indoor temperature compared to the predicted temperature by the Fanger's model. This finding is important for the local HVAC design engineers, since adjusting the setting for people's comfort temperature in an air-conditioning system by 0.3°C will have an impact on the energy consumption of a building.

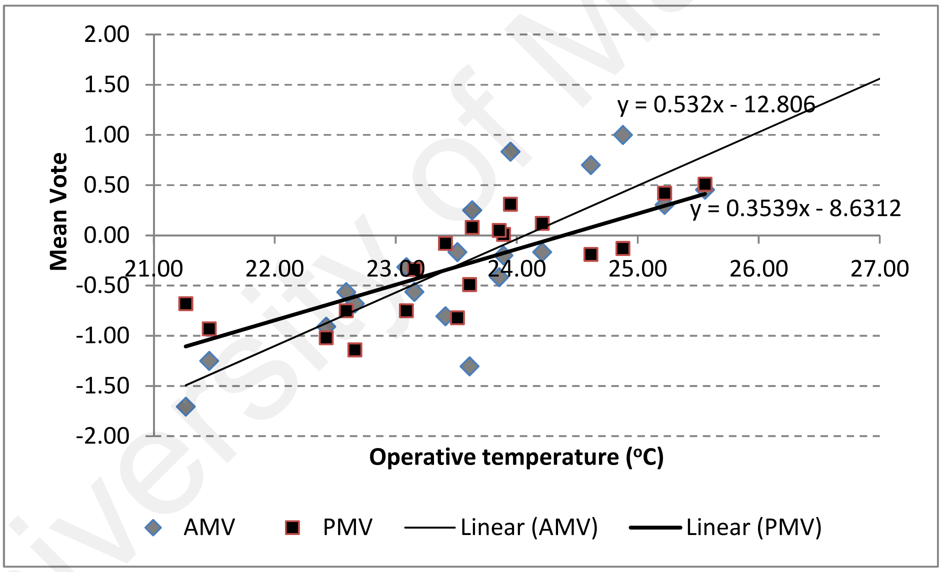

Figure 5.8 : Graph of mean thermal sensation vote versus operative temperature.

5.4 Adaptive Thermal Comfort Model

The relationship between the indoor neutral temperature and the outdoor temperature must be determined in developing an adaptive thermal comfort model. Table 5.3 shows the neutral temperature and the outdoor temperature collected from the survey in seven office buildings. Note that the neutral temperature in Table 5.3 is determined from the vote of zero in the correlation between the actual mean vote and the operative temperature for each office building as shown in Appendix I.

Table 5.3 : Neutral temperature and outdoor temperature of seven office buildings.

Office	T_n (°C)	T_{out} (°C)
A	24.0	29.4
B	23.8	28.6
C	24.6	34.5
D	25.8	33.4
E	25.9	30.8
F	25.3	32.5
G	23.8	33.3

By plotting the data shown in Table 5.3, a linear regression model was generated, as shown in Figure 5.9 and Equation (5.4).

$$T_n = 0.1331\ T_{out} + 20.492 \qquad R^2 = 0.1002 \tag{5.4}$$

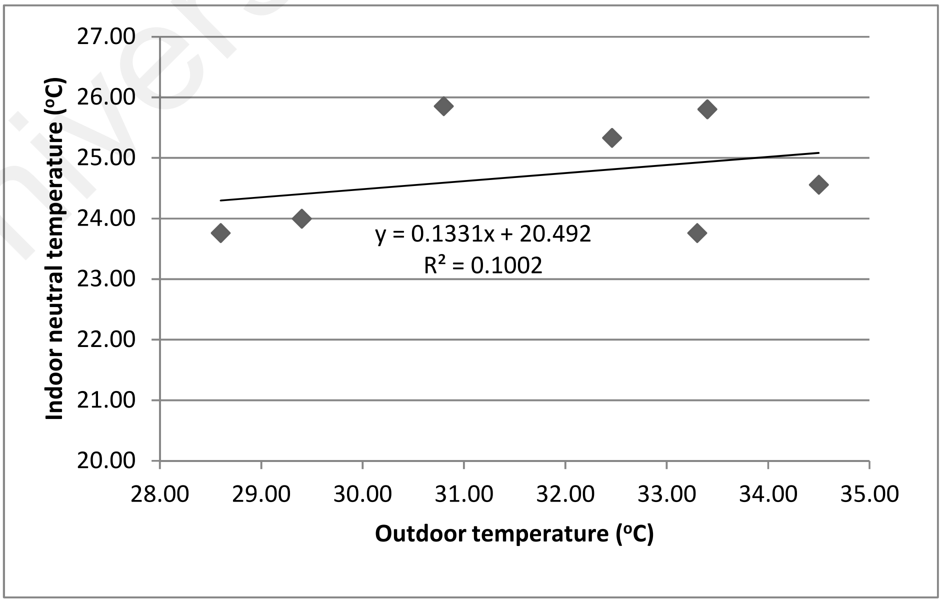

Figure 5.9 : Adaptive thermal comfort model for office building in hot and humid Malaysia.

Note that the indoor neutral temperature increases by about 1^oC for a 7.5^oC increment in the outdoor temperature. According to the findings by Mui & Chan (2003) from humid, sub-tropical Hong Kong, the neutral temperature increases by about 1^oC for every 6^oC increase in the outdoor temperature. The difference between these results shows that different climates will result in a different thermal sensation. A number of field studies have also found that the neutral temperature varies with the climate or season (Cena & de Dear, 2001).

The slope in Equation (5.4) is almost identical to that proposed by Mui & Chan (2003) and Milne (1995) as shown in Equations (2.8) and (2.12), respectively. However, the constant of Equation (5.4) is different from the other researchers as shown in Equations (2.8) to (2.17). Furthermore, the R-squared value of Equation (5.4) is small compared to the unity, and this questions the suitability of the model. Residual analysis was carried out to check the suitability of the adaptive thermal comfort model. The calculation of the residual analysis is shown in Appendix J. The residual plots in Figure 5.10 behave randomly and this indicates that the adaptive model in Equation (5.4) provides a decent fit to the data. In other words, a linear regression model is suitable for the data.

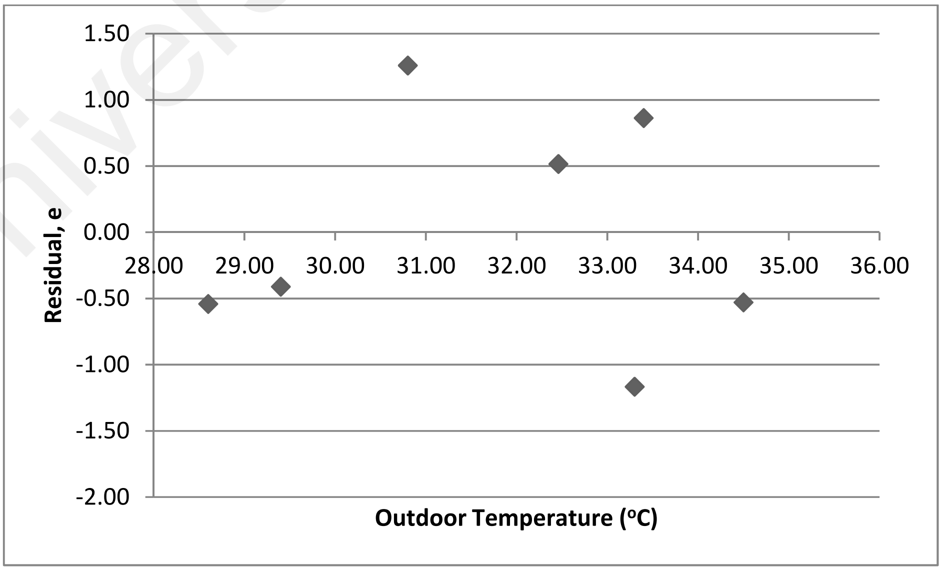

Figure 5.10 : Residual plots.

Besides that, the bias uncertainty analysis is used to check the validity of the field measurement data. A set of data is considered valid for use if the error for the bias uncertainty is less than 10% (Yau, 2004). After calculation, the four basic parameters in this study, which are the T_{air}, T_{globe}, RH and T_{out}, are all below 10% error bias uncertainty (as shown in Appendix K). Thus, these measured parameters are valid to be used in developing the adaptive thermal comfort model as shown in Equation (5.4).

However, the error analysis for air velocity is much higher compared to that of the other parameters. The highest value recorded is 10.53% uncertainty for the air velocity. This is because an accurate measurement of a low air velocity is difficult (Melikov *et al.*, 2007). Furthermore, a more reliable sensor reading is possible only if the air velocity is more than 2 m/s (Thomas *et al.*, 1998). In the present research, the air velocity measured was in the range of 0.02-0.18 m/s. This shows that the air velocity was very low and difficult to measure accurately. Nevertheless, the bias uncertainty error for the air velocity is still at an acceptable level since it is just slightly above 10%.

5.4.1 Upper and lower limits of the adaptive model

In order to obtain an adaptive thermal comfort model that is suitable for application in the office buildings in Malaysia, a calibration to determine the upper and lower limits of the model is needed. According to the ASHRAE Fundamentals Handbook (2009), a comfort zone is a zone of 20% maximum allowable occupants' dissatisfaction.

From Figure 5.7, for a maximum 20% actual percentage dissatisfied (APD), the range for indoor temperature is 23.3-25.2^{o}C. The outdoor temperature range is 21.1 - 35.4^{o}C as shown in Figure 5.11. If the outdoor temperature is lower than 21.1^{o}C, the recommended indoor neutral temperature will be constant at 23.3^{o}C. In turn, when the outdoor temperature is higher than 35.4^{o}C, the recommended indoor neutral temperature will be constant at 25.2°C. In designing the HVAC system, this model can help to reduce the energy consumption as well as achieve a high level of thermal comfort for office occupants in the tropics.

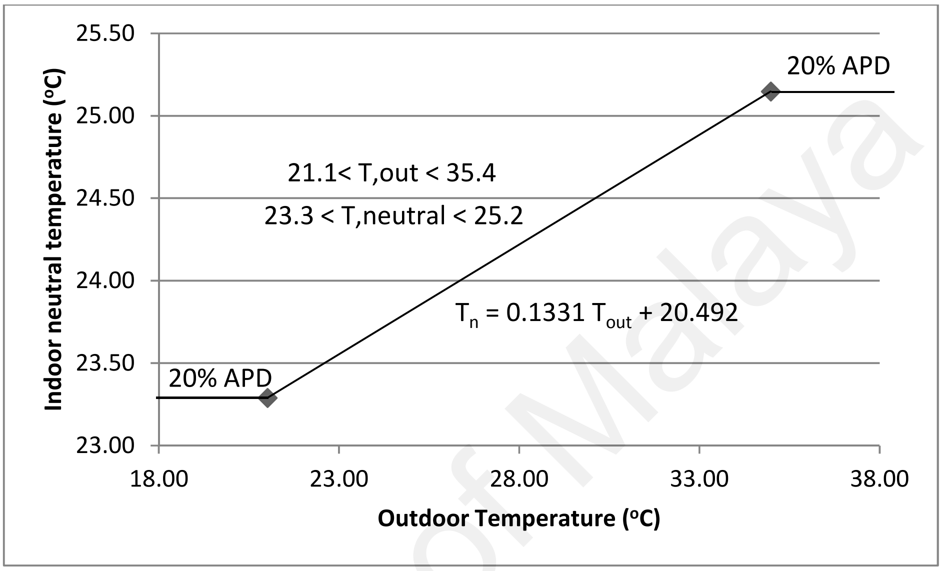

Figure 5.11 : Upper and lower limits of adaptive thermal comfort model.

5.4.2 Verification of the proposed adaptive model

The adaptive thermal comfort model proposed for the office buildings was verified by using the same results from the same experiment in a chamber as shown in Chapter 4. Figure 4.11 shows that the indoor neutral temperature collected during the experiment was 24.73°C. In contrast, by using the adaptive model proposed in Equation (5.4), the neutral temperature calculated was 24.60°C at an average outdoor temperature of 30.83°C. The difference between the neutral temperature calculated using the adaptive model and the neutral temperature measured during the experiment was 0.13°C or 0.53%. This minor discrepancy was due to the slight difference of the clothing values and activity levels between the offices and the experimental chamber.

For the office buildings, the average clothing value and activity level are 0.51 clo and 1.23 met, respectively. For the chamber, the average value was 0.41 clo and 1.14 met. This implies that people with a different clothing insulation and activity level will have a different feeling on their thermal comfort level. Since the discrepancy was only 0.53% as mentioned above, the adaptive model proposed in this study is therefore valid to be used in Malaysia's office buildings.

5.5 Summary

In this chapter, the relationship between the operative temperature and clothing insulation, metabolic rate and air velocity was successfully established. The adaptive model that has been developed in this study is $T_n = 0.1331\ T_{out} + 20.492$, with its upper and lower limits of 23.3 – 25.2°C for the indoor neutral temperature and 21.1 - 35.4°C for the outdoor temperature, respectively. This model is suitable for use in the office buildings in Malaysia since the error is only 0.53 % between the neutral temperatures calculated using the proposed adaptive model and the neutral temperature measured during an experimental study in a chamber.

The most comfortable or neutral temperature found from the field study in the office buildings was 24.1°C. In comparison with the neutral temperature of 24.0°C recommended by the ASHRAE Applications (2007), the proposed neutral temperature for the office buildings in this study is only 0.1°C higher. Although the difference is only 0.1°C, this still has a significant impact on the energy saving potential of a building. Various studies have been conducted to determine the potential energy reduction when increasing the set point temperature of the air-conditioners (Kongkiatumpai, 1999; Saidur, 2009). It was found that a 1°C increase in the temperature of the air conditioner accounts for about 6% savings in the energy consumption (Atthajariyakul & Leephakpreeda, 2004; Atthajariyakul & Lertsatittanakorn, 2008). Hence, an increment of 0.1°C room temperature setting could give 0.6% energy savings in an air-conditioner system.

The next chapter will explain the results and discussion for the field work study in lecture halls.

Chapter 6 Results and Discussion – Field Work Study in Lecture Halls

Surveys were done in the six lecture halls in University of Malaya, Kuala Lumpur in the years 2009 and 2010. The total number of students who took part in the subjective measurement was 178 people. The field measurements took about three hours for each of the lecture hall. The questionnaires were given to all students in the lecture hall during the field measurements and the response rate was 100%. The ratio of respondents between male-female was 1:0.09 and the age groups was between 18 - 25 years old. The physical parameters and the results from the subjective measurements are shown in Tables 6.1 and 6.2, respectively. The detail measurements are shown in Appendix L.

Table 6.1 : Physical parameters measured and calculated in lecture halls.

Lecture Hall	Point	T_{air} (°C)	T_{globe} (°C)	V (m/s)	RH (%)	MRT (°C)	T_{op} (°C)
A	1	24.0	24.0	0.14	51.2	24.0	24.0
	2	22.1	24.3	0.24	48.5	26.8	24.5
	3	21.2	23.6	0.21	47.4	26.1	23.7
	4	19.7	23.3	0.23	46.0	27.3	23.5
	5	19.1	22.7	0.21	46.5	26.6	22.8
	6	19.1	22.5	0.16	46.4	25.7	22.4
B	1	21.3	22.4	0.22	61.8	23.7	22.5
	2	21.4	22.5	0.12	62.5	23.4	22.4
	3	21.0	22.6	0.17	62.6	24.2	22.6
	4	20.9	22.6	0.10	63.1	23.9	22.4
	5	21.0	22.7	0.16	62.4	24.3	22.6
	6	21.0	22.7	0.10	63.0	23.9	22.5
C	1	21.9	22.7	0.18	69.8	23.5	22.7
	2	22.2	22.7	0.10	68.0	23.1	22.6
	3	22.8	22.7	0.10	68.8	22.7	22.7
	4	22.7	22.7	0.12	67.1	22.7	22.7
	5	22.1	22.7	0.12	69.6	23.2	22.6
	6	22.0	22.6	0.21	69.7	23.3	22.6
D	1	22.9	22.1	0.11	49.1	21.4	22.2
	2	22.1	22.1	0.12	47.4	22.1	22.1

	3	22.2	22.2	0.12	48.2	22.2	22.2
	4	23.2	22.1	0.10	48.5	21.3	22.2
	5	22.0	22.2	0.21	49.9	22.5	22.2
	6	21.8	22.2	0.15	48.5	22.6	22.2
E	1	21.4	22.4	0.16	48.1	23.4	22.4
	2	21.6	22.3	0.19	48.2	23.0	22.3
	3	21.8	22.3	0.18	47.7	22.8	22.3
	4	21.4	22.3	0.17	48.5	23.2	22.3
	5	21.6	22.4	0.17	49.0	23.2	22.4
	6	21.0	22.3	0.11	50.7	23.3	22.2
F	1	24.6	25.8	0.10	61.4	26.6	25.6
	2	24.6	25.6	0.09	61.8	26.3	25.4
	3	25.0	25.2	0.14	63.4	25.4	25.2
	4	25.3	25.2	0.10	63.8	25.2	25.2
	5	25.3	25.3	0.09	62.1	25.3	25.3
	6	25.3	25.2	0.09	61.5	25.1	25.2

Table 6.2 : Subjective measurements of occupants in lecture halls.

Lecture Hall	Point	met	clo	AMV	APD (%)	PMV	PPD (%)
A	1	1.15	0.75	-0.25	25.0	-0.07	5.0
	2	1.00	0.54	-1.50	25.0	-1.15	33.0
	3	1.00	0.76	-1.17	16.7	-0.77	17.0
	4	1.08	0.54	-1.00	0.0	-1.23	37.0
	5	1.00	0.63	-2.50	100.0	-1.49	51.0
	6	1.00	0.36	-2.00	100.0	-2.39	91.0
B	1	1.08	0.60	-0.20	40.0	-1.08	30.0
	2	1.00	0.58	-1.60	80.0	-1.14	32.0
	3	1.12	0.72	-1.40	20.0	-0.62	13.0
	4	1.00	0.50	-2.00	100.0	-1.36	43.0
	5	1.00	0.72	-1.40	20.0	-0.89	22.0
	6	1.00	0.72	0.20	20.0	-0.71	16.0
C	1	1.00	0.72	-1.50	25.0	-0.83	20.0
	2	1.10	0.65	-1.25	25.0	-0.43	9.0
	3	1.00	0.63	-1.50	25.0	-0.73	16.0
	4	1.20	0.72	-1.50	25.0	-0.12	5.0
	5	1.16	0.37	-1.40	40.0	-0.94	23.0
	6	1.00	0.72	-2.00	100.0	-0.92	23.0
D	1	1.00	0.61	-0.80	40.0	-1.16	33.0
	2	1.00	0.63	-1.75	75.0	-1.19	35.0
	3	1.00	0.72	-1.50	25.0	-0.92	23.0

	4	1.00	0.63	-1.50	25.0	-1.04	28.0
	5	1.00	0.72	-1.40	20.0	-1.17	34.0
	6	1.13	0.54	-0.50	50.0	-1.17	34.0
E	1	1.04	0.72	-1.40	20.0	-1.04	28.0
	2	1.00	0.72	-1.50	25.0	-1.14	33.0
	3	1.00	0.72	-1.40	40.0	-1.10	31.0
	4	1.00	0.66	-1.40	40.0	-1.25	38.0
	5	1.24	0.67	-1.40	20.0	-0.56	12.0
	6	1.00	0.63	-1.50	50.0	-1.13	32.0
F	1	1.06	0.72	1.57	57.1	0.51	10.0
	2	1.03	0.73	1.00	0.0	0.30	7.0
	3	1.06	0.57	-1.29	28.6	0.05	5.0
	4	1.06	0.52	-1.00	0.0	0.10	5.0
	5	1.06	0.72	0.00	0.0	0.44	9.0
	6	1.06	0.49	-0.57	0.0	0.00	5.0

6.1 Behavioural adaptations

The following sub-sections describe the behavioural adaptations, which are commonly represented by the clothing insulation, activity level and air velocity.

6.1.1 Clothing insulation

The relationship between the clo value and both the indoor operative temperature and the outdoor temperature are shown in Figures 6.1 and 6.2 respectively.

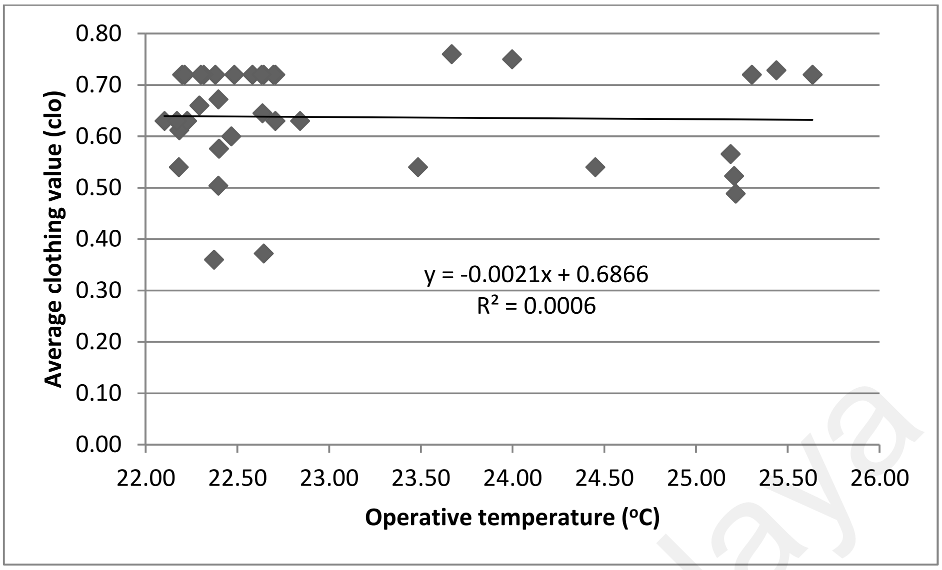

Figure 6.1 : Relationship between clothing insulation and indoor operative temperature.

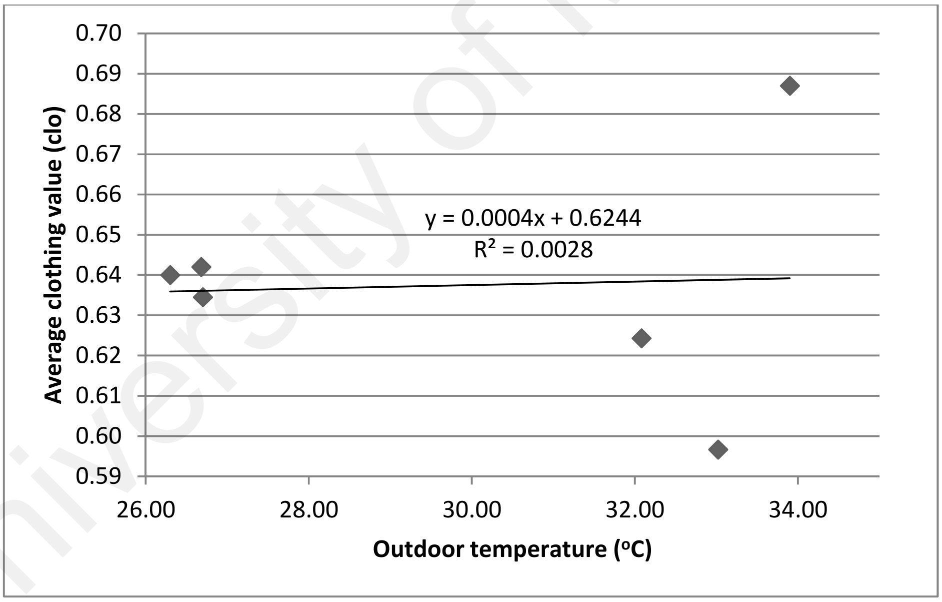

Figure 6.2 : Relationship between clothing insulation and outdoor temperature.

By referring to Figures 6.1 and 6.2, the correlation between the clothing insulation and both the indoor operative and the outdoor temperature for the lecture halls in Malaysia are given by Equations (6.1) and (6.2).

$$Clo = -0.0021\ T_{op} + 0.6866 \quad (6.1)$$

$$Clo = 0.0004\ T_{out} + 0.6244 \quad (6.2)$$

Other researchers have carried out the similar analyses, and their results are shown in Equations (2.2) to (2.4). The correlation for the lecture halls as shown in Figures 6.1 and 6.2 are nearly a horizontal line compared to Equations (2.2) and (2.3). This indicates that for the students in University of Malaya, their clothing ensembles were almost independent of the indoor operative and the outdoor temperature. It is a norm or culture for the university's students to wear a jean, t-shirt and jacket to the lecture. Students always wear a jacket or long-sleeved shirt to class because most of them travel to their faculty by motorcycle. Jacket or long-sleeved shirt with jeans could help to protect their skins from direct sunlight in a hot weather in Malaysia. Hence, this makes the custom for all the university's students in their attire without taking into account the indoor and the outdoor temperature.

6.1.2 Activity level

The activity level of occupants is measured in metabolic rate. In Figure 6.3, it is found that the regression line is almost horizontal with a maximum of 1.24 met, a minimum of 1.00 met and an average of 1.04 met. In this case, the average met was lower than 1.2 met found by different researchers (Bouden & Ghrab, 2005; de Dear & Brager, 1998; Mui & Chan, 2003) for office buildings because the students always seated quietly in the lecture hall compared to the office workers, who were doing sedentary work such as typing and filing. Figure 6.3 indicates that the activity level is independent of the indoor operative temperature. This is acceptable because a person's activity level should depend on his or her job requirement itself rather than the ambient temperature.

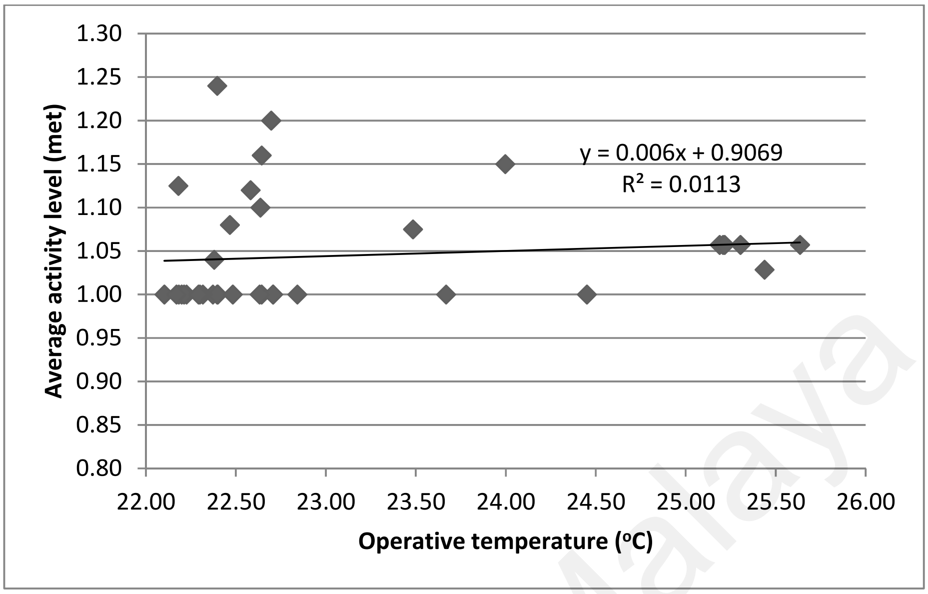

Figure 6.3 : Relationship between activity level and operative temperature.

6.1.3 Air velocity

Figure 6.4 shows the linear regression between the indoor air velocity and the operative temperature in the lecture halls and is depicted in Equation (6.3).

$$V = -0.0097\ T_{op} + 0.3707 \qquad (6.3)$$

Note that the slope found in this study is a negative slope, but the slope found by de Dear & Brager (1998) and Mui & Chan (2003) in Equations (2.6) and (2.7) are a positive slope. This result is similar to the results obtained for the hospitals and offices in Chapters 4 and 5. Note that the lecture halls were also using a centralized air-conditioning system, where the air speed is not under the students' local control. Hence, the higher the indoor operative temperature, the lower the air velocity will be obtained as shown in Figure 6.4.

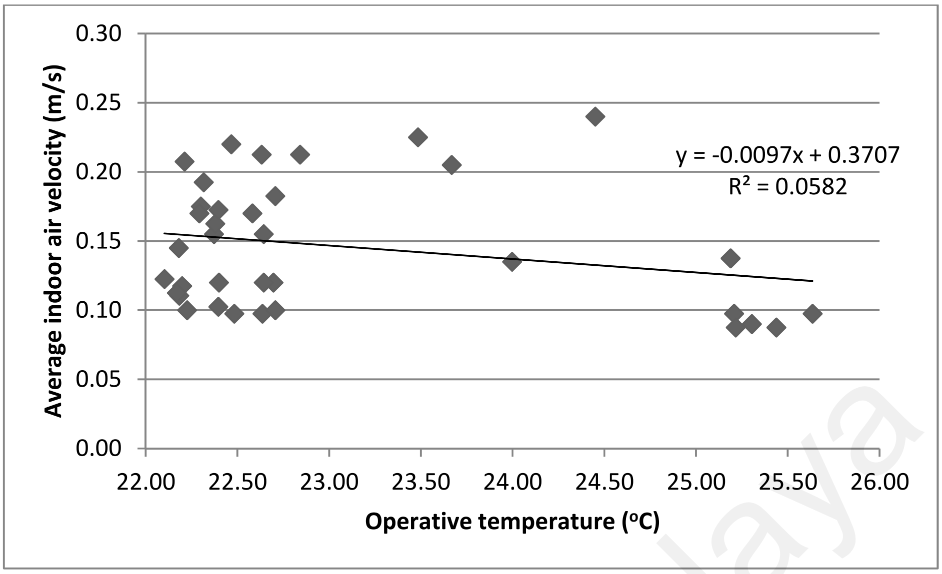

Figure 6.4 : Relationship between indoor air velocity and operative temperature.

6.2 Thermal acceptability

The relationship between the percentage dissatisfied and the operative temperature is shown in Figure 6.5. In order to get an actual percentage dissatisfied (APD) below 20% as suggested by the ASHRAE Fundamentals Handbook (2009), the operative temperature range must be 23.9-26.0^{o}C. The temperature range to keep the predicted percentage dissatisfied (PPD) below 20% is 23.5-30.8^{o}C. The broad temperature range for 20% PPD indicates that the Fanger's model has a higher prediction for the human adaptation ability to the changes in the surrounding temperature.

Students in the lecture halls showed a narrower thermal acceptance range of 23.9-26.0^{o}C compared to the predicted value of 23.5-30.8^{o}C when using Fanger's model. The temperature range from a maximum of 20% APD is acceptable because in the present research, the study focused on the air-conditioned lecture halls. On the other hand, for a maximum of 20% PPD, the temperature range is too broad because it is impracticable to have an operative temperature of 30.8°C in an air-conditioned lecture hall in Malaysia. The students will find 30.8°C to be a hot environment and thermally uncomfortable for an air-conditioned space. Normally, the outdoor temperature in Malaysia ranges between 27 to 36 °C during a sunny day.

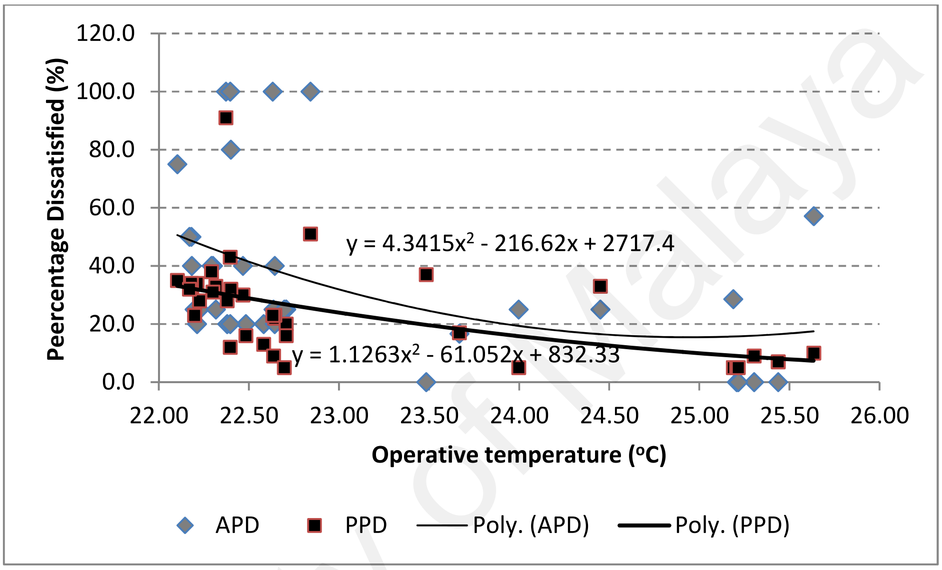

Figure 6.5 : Graph of percentage dissatisfied versus operative temperature.

6.3 Thermal neutrality

Thermal neutrality is the operative temperature at the mean thermal sensation vote of zero. From Figure 6.6, the neutral temperature for the predicted mean vote and the actual mean vote were 25.0°C and 25.7°C, respectively. The discrepancy of 0.7°C between the PMV and AMV is an important value, and this means that in the actual case, students in the lecture halls prefer a warmer indoor environment compared to the predicted environment from the Fanger's model. This result is important for the local HVAC design engineers, since raising the setting of people's comfort temperature in an air-conditioning system by 0.7°C could save a significant amount of energy consumed in a building.

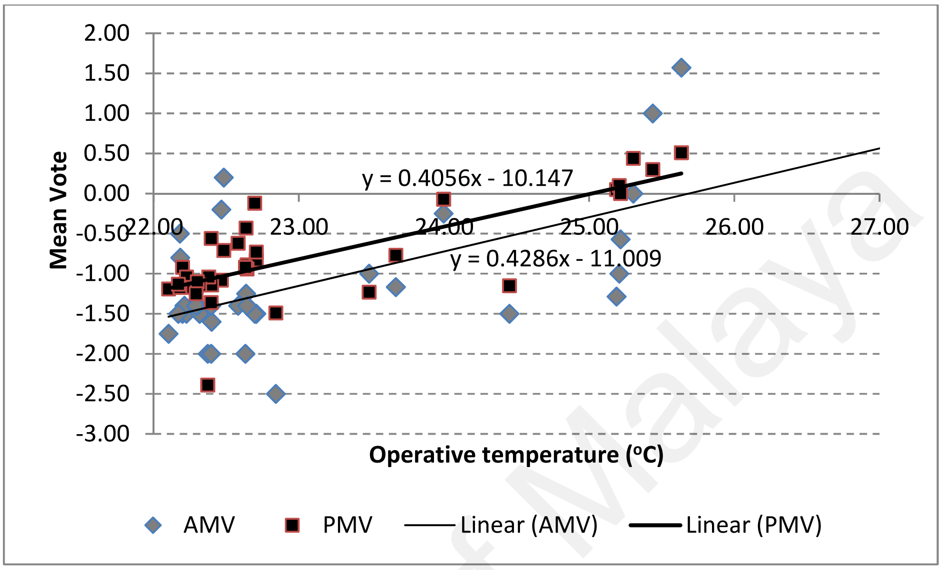

Figure 6.6 : Graph of mean thermal sensation vote versus operative temperature.

6.4 Adaptive Thermal Comfort Model

The correlation between the indoor neutral temperature and the outdoor temperature has to be determined in developing an adaptive thermal comfort model. Table 6.3 shows the neutral temperature and the outdoor temperature collected from the study in six lecture halls. The neutral temperature in Table 6.3 is determined from the vote of zero in the relationship between the actual mean vote and the operative temperature for each lecture hall as shown in Appendix M.

Table 6.3 : Neutral temperature and outdoor temperature of lecture halls.

Lecture Hall	T_n (°C)	T_{out} (°C)
A	25.6	33.0
B	24.6	26.3
C	23.9	26.7
D	22.8	26.7
E	25.8	33.9
F	25.3	32.1

By plotting the data shown in Table 6.3, a linear regression model was generated, as shown in Figure 6.7 and Equation (6.4).

$$T_n = 0.275\ T_{out} + 16.487 \qquad R^2 = 0.7204 \qquad (6.4)$$

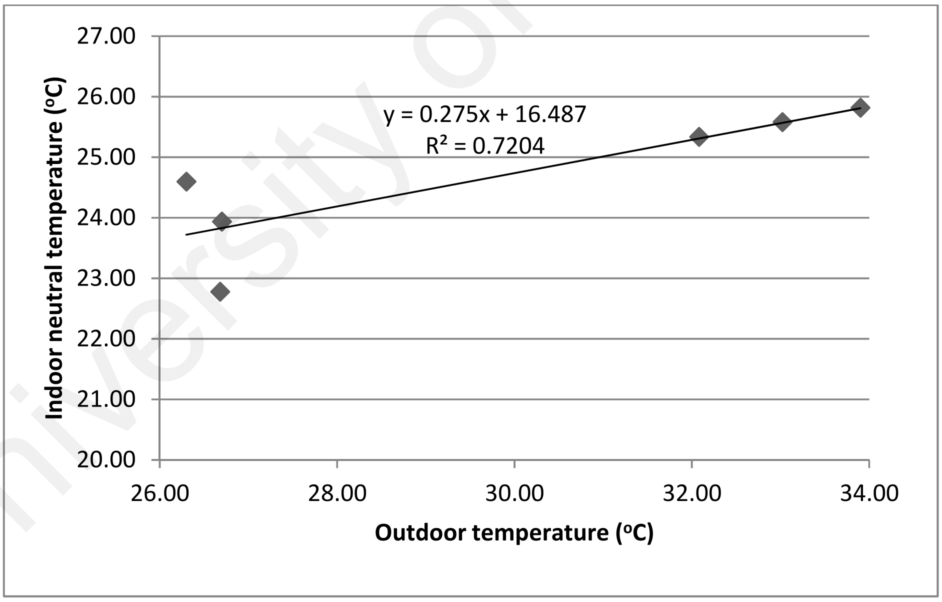

Figure 6.7 : Adaptive thermal comfort model for lecture halls in hot and humid Malaysia.

The indoor neutral temperature increases by about 1°C for a 3.6°C increment in the outdoor temperature. Based on the study by Mui & Chan (2003) in the humid, sub-tropical Hong

Kong, the neutral temperature increases by about 1°C for every 6°C increase in the outdoor temperature. The dissimilarity between these results shows that different climates will give a different thermal sensation.

From Equation (6.4), the pattern of the linear regression is approximately similar to those found by the other researchers as shown in Equations (2.8) to (2.12). The R-squared value in Equation (6.4) is 0.7204, which is near to unity. Although $R^2 = 0.7204$ shows that the model is acceptable to be applied, but the residual analysis still needed to be carried out to check whether a linear regression model is appropriate for the data. The calculation of the residual analysis is shown in Appendix N. Figure 6.8 shows that the residual plots behave randomly. This means that Equation (6.4) gives a decent fit to the data and thus a linear regression model is appropriate for the data.

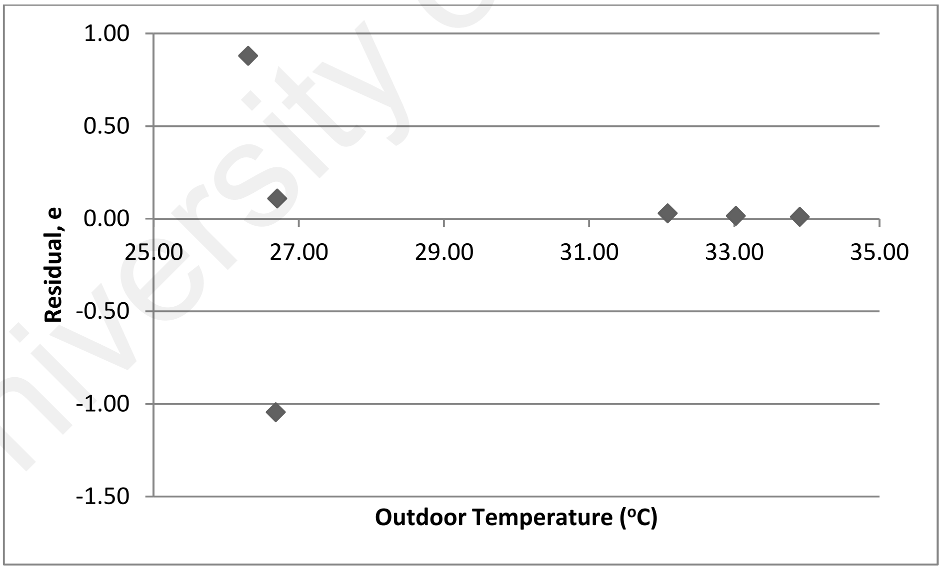

Figure 6.8 : Residual plots.

In addition, to check the validity of the field measurement data, the bias uncertainty analysis is applied here. A set of data is considered applicable if the error for the bias uncertainty is less than 10% (Yau, 2004). From the analysis, the four basic parameters in this study, which are T_{air}, T_{globe}, RH and T_{out}, are all below 10% error bias uncertainty (as shown in Appendix O). Hence, these parameters measured during the field work are applicable in determining the adaptive thermal comfort model as shown in Equation (6.4).

Nevertheless, the error analysis for the air velocity is much higher compared to that of the other parameters. The highest value recorded is 13.79% uncertainty for the air velocity. This is because a precise measurement of a low air velocity is hard (Melikov *et al.*, 2007). Moreover, a reliable sensor reading is achievable only if the air velocity is more than 2 m/s (Thomas *et al.*, 1998). In this study in the lecture halls, the air velocity measured was in the range of 0.09-0.24 m/s. This low air velocity was difficult to measure precisely. However, the bias uncertainty error for the air velocity is still at an acceptable level since it is slightly above 10%.

6.4.1 Upper and lower limits of the adaptive model

A calibration to determine the upper and lower limits of the adaptive thermal comfort model is necessary. Based on the ASHRAE Fundamentals Handbook (2009), a comfort zone is where 80% of the occupants find the environment thermally acceptable or a zone of 20% maximum allowable occupants' dissatisfaction.

In Figure 6.9, for a maximum of 20% actual percentage dissatisfied (APD), the range for the indoor neutral temperature is 23.9 - 26.0^{o}C. The outdoor temperature range is 27.0 – 34.6^{o}C. If the outdoor temperature is lower than 27.0^{o}C, the recommended indoor neutral temperature will be constant at 23.9^{o}C. In turn, when the outdoor temperature is higher than 34.6^{o}C, the recommended indoor neutral temperature will be constant at 26.0^{o}C. In designing the HVAC system, this model can help to reduce the energy consumption as well as achieve a high level of thermal comfort for the students in tertiary institutions in the tropics.

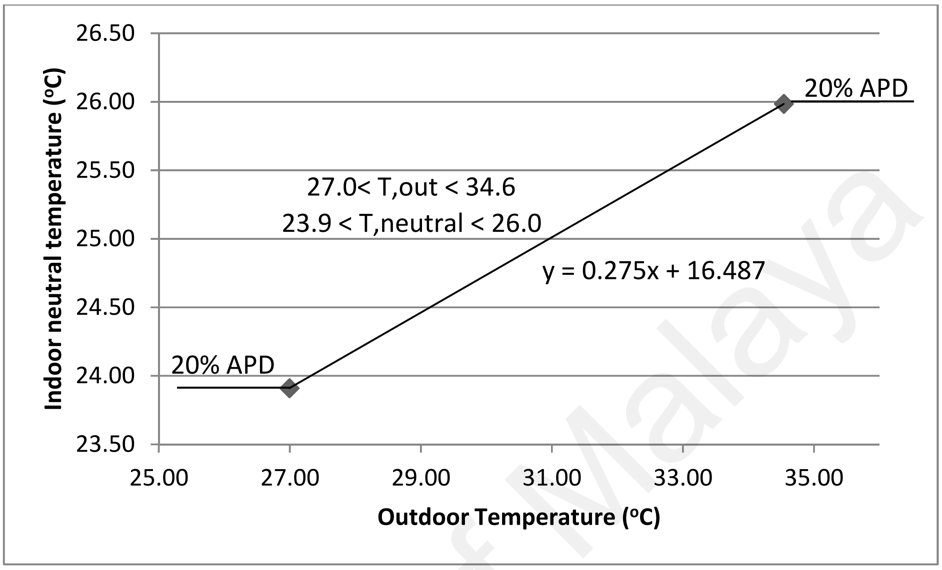

Figure 6.9 : Upper and lower limits of adaptive thermal comfort model.

6.4.2 Verification of the proposed adaptive model

The proposed adaptive thermal comfort model for the lecture halls was verified by using the similar experiment and results from Chapters 4 and 5. From Figure 4.11, the indoor neutral temperature collected during the experiment in a chamber was 24.73°C. On the other hand, the neutral temperature calculated was 24.97°C when using the adaptive model proposed in Equation (6.4). The average outdoor temperature of 30.83°C measured during the experiment was used in the calculation.

The discrepancy between the neutral temperature calculated using the adaptive model and the neutral temperature measured during the experiment was 0.24°C or 0.96 %. This discrepancy is due to the difference of the clothing values and the activity levels between the lecture halls and the experimental chamber. For the lecture halls, the average clothing value and activity level are 0.64 clo and 1.04 met, respectively. For the chamber, the average value was 0.41 clo and 1.14 met. This means that people's thermal comfort level may vary when they have different activity level and clothing insulation. Since the difference is only 0.96 %, thus the adaptive model developed in this chapter is applicable to the lecture halls in Malaysia.

6.5 Summary

In this chapter, the relationship between the operative temperature and the clothing insulation, the metabolic rate and the air velocity was successfully established. The adaptive model proposed in this chapter is $T_n = 0.275\ T_{out} + 16.487$, with its upper and lower limits of 23.9 - 26.0°C for the indoor neutral temperature and 27.0 – 34.6°C for the outdoor temperature, respectively. This model is applicable to the lecture halls in Malaysia since the error is only 0.96 % between the neutral temperatures calculated using the adaptive model and the neutral temperature measured during an experiment in a chamber.

The most comfortable or neutral temperature found from the field study in the lecture halls was 25.7°C. In comparison to the recommended temperature of 24.0°C by the ASHRAE Applications (2007), the proposed neutral temperature for the lecture halls in this study is 1.7°C higher. This difference of 1.7°C has a significant impact on the energy saving potential of a building, because by increasing the room temperature setting from 24.0°C to 25.7°C, one could decrease the cooling load and thus save a significant amount of energy.

The next chapter will describe the comparison of results attained from field work study in the hospitals, office buildings and lecture halls.

Chapter 7 Results Comparisons

The results obtained for the hospitals, office buildings and lecture halls in Chapters 4 to 6 are compared and discussed in this chapter. Note that the occupants in different kind of buildings will have different thermal requirements and perceptions (as discussed in Chapter 1). Thus, the results found from the the fieldwork study in the three different buildings are shown in Table 7.1.

Table 7.1 : Comparisons of results obtained from hospitals, offices and lecture halls.

Item No.	Results	Hospitals	Offices	Lecture Halls
1	Clothing value vs Operative temperature	Clo = -0.0523 T_{op} + 1.8198	Clo = -0.0051 T_{op} + 0.5962	Clo = -0.0021 T_{op} + 0.6866
2	Clothing value vs Outdoor temperature	Clo = -0.0504 T_{out} + 2.2007	Clo = 0.0015 T_{out} + 0.4306	Clo = 0.0004 T_{out} + 0.6244
3	Clothing value	Max = 1.37 clo Min = 0.38 clo Average = 0.61 clo	Max = 0.80 clo Min = 0.39 clo Average = 0.51 clo	Max = 0.76 clo Min = 0.36 clo Average = 0.64 clo
4	Metabolic rate	Max = 1.70 met Min = 1.08 met Average = 1.36 met	Max = 1.65 met Min = 1.06 met Average = 1.23 met	Max = 1.24 met Min = 1.00 met Average = 1.04 met
5	Air velocity vs Operative temperature	V = -0.0127 T_{op} + 0.4747	V = -0.0088 T_{op} + 0.2872	V = -0.0097 T_{op} + 0.3707

6	Thermal acceptability	APD < 20% : T_{op} = 23.7-27.7°C PPD < 20% : T_{op} = 19.2-28.5°C	APD < 20% : T_{op} = 23.3-25.2°C PPD < 20% : T_{op} = 21.9-32.0°C	APD < 20% : T_{op} = 23.9-26.0°C PPD < 20% : T_{op} = 23.5-30.8°C
7	Thermal neutrality	AMV : T_n = 26.4°C PMV : T_n = 23.8°C	AMV : T_n = 24.1°C PMV : T_n = 24.4°C	AMV : T_n = 25.7°C PMV : T_n = 25.0°C
8	Adaptive thermal comfort model	$T_n = 0.3314\ T_{out} + 14.858$ ($R^2 = 0.0535$)	$T_n = 0.1331\ T_{out} + 20.492$ ($R^2 = 0.1002$)	$T_n = 0.275\ T_{out} + 16.487$ ($R^2 = 0.7204$)
9	Residual Plots	Behave randomly	Behave randomly	Behave randomly
10	Bias uncertainty	Parameters V, T_{air}, T_{globe}, RH and T_{out} : Error < 10% Parameter V : Error = 9.84%	Parameters T_{air}, T_{globe}, RH and T_{out} : Error < 10% Parameter V : Error = 10.53%	Parameters T_{air}, T_{globe}, RH and T_{out} : Error < 10% Parameter V : Error = 13.79%
11	Upper and lower limits of adaptive model	$25.4 < T_{out} < 35.0$ °C	$21.1 < T_{out} < 35.4$ °C	$27.0 < T_{out} < 34.6$ °C

12	Verification of the adaptive thermal comfort model	Adaptive model: T_n = 25.07°C Verification: T_n = 24.73°C Error : 0.34°C or 1.36 %	Adaptive model: T_n = 24.60°C Verification: T_n = 24.73°C Error : 0.13°C or 0.53 %	Adaptive model: T_n = 24.97°C Verification: T_n = 24.73°C Error : 0.24°C or 0.96 %

Comments on Item No. :

1 & 2. In hospitals, the staffs were having a minor change in their clothing when indoor and outdoor temperature increases. This is shown by the gentle slopes of the equations shown in Item Nos. 1 and 2.

On the other hand, in the office buildings and lecture halls, the occupants almost did not make any changes in their clothing since the slopes of the equations shown are close to zero. This indicates that office workers and students in lecture halls were having their clothing ensembles without taking into consideration neither the indoor nor outdoor temperature.

3. Hospitals record the highest maximum clothing value, followed by the offices and lecture halls. Since some of the hospital personnel were wearing lab coat, so they will have higher maximum clothing value compared to the office workers and students in lecture halls.

However, the lecture halls record the highest average clothing value, followed by the hospitals and offices. This is because most of the students in the lecture halls were wearing jacket during the survey was conducted.

4. Hospitals record the highest maximum, minimum and average metabolic rate, followed by the offices and lecture halls. The hospital staffs had higher metabolic rate because they always walking about to check the patients, pushing a trolley and so on. In contrast, the office occupants always perform sedentary works such as filing, typing or writing. The lowest metabolic rate recorded by the students in the lecture halls was due to their intellectual work, seated quietly or writing in the class.

5. Since all the buildings surveyed were using the centralized air-conditioning system, with no local control on the air speed, thus they have a similar trend of linear regression. The details were explained in Chapter 4.1.3.

6. The acceptable temperature range predicted by PPD is wider than the actual APD for all the hospitals, office and lecture halls. Generally, people in Malaysia accept a narrower indoor operative temperature from 23.3 to 27.7^{o}C.

7. The neutral temperatures or comfort temperatures found based on AMV are higher than those found by PMV for both the hospitals and lecture halls. This means that in the actual case, occupants prefer a higher neutral temperature than the predicted temperature by PMV.

   In contrast, the office workers were found to prefer a lower neutral temperature of 24.1^{o}C than the predicted temperature of 24.4^{o}C by PMV. Field studies by Hwang *et al.* (2007) also show that in the actual cases, occupants in offices prefer a cooler ambience rather than a predicted neutral environment. Note that the practical engineers in Malaysia usually apply the rule of thumb of 24.0^{o}C in designing the set-point temperature for an air-conditioning system. Hence, the neutral temperature of 24.1°C found for the office workers in this study is still beyond the typical set-point temperature practiced by local engineers. Although the difference is only 0.1°C, but it could save a certain amount of energy on a long term basis.

8. All the adaptive thermal comfort models developed for hospitals, offices and lecture halls have a similar pattern of linear regression.

9. In the residual analysis, the residual plots behave randomly for all the three types of buildings. Thus, the linear regression models are suitable for the relationship between neutral and outdoor temperatures.

10. The bias uncertainty errors for all the basic parameters are below 10%. However, the offices and lecture halls record a higher error in air velocity compared to the hospitals. This is because the air velocity measured in the offices and lecture halls were lower in the range of 0.02-0.18 m/s and 0.09-0.24 m/s, respectively. The hospitals record a higher air velocity range of 0.05-0.57 m/s. Note that the lower the air velocity, the more difficult to measure an accurate measurement. Hence, the error occurred will be higher.

11. The outdoor temperature upper limits are around 35°C for the hospitals, offices and lecture halls. However, the lower limits are found to be different among the buildings. Again, this indicates that the occupants in different type of buildings will give different thermal sensation and requirement.

12. The neutral temperature found during the experiment in a chamber was 24.73^{o}C with an average outdoor temperature of 30.83^{o}C. The same outdoor temperature of 30.83^{o}C was used to calculate the neutral temperature from the developed adaptive models for the hospitals, offices and lecture halls. After calculation, it was found that the maximum error was 1.36 % only. Hence, it can be concluded that the developed adaptive thermal comfort models are practically applicable in Malaysia.

Chapter 8 Potential Energy Savings

Nowadays, global climate change has become a big concern throughout the world. At the same time, people are trying to go ‘green’ in every aspect in their life. Energy saving is one of the ways to go ‘green’ and stop climate change. Air-conditioning systems are typically used by many people in hot and humid, Malaysia. People in Malaysia could help to save energy and money by simply increasing the temperature setting in their air-conditioning systems.

In order to save energy and at the same time achieve an optimum thermal comfort level, people in Malaysia could refer to the results obtained from this research study. The results in the previous chapters showed that the comfort or neutral temperature found for the hospitals, offices and lecture halls are 26.4^{o}C, 24.1^{o}C and 25.7^{o}C, respectively. Note that the mechanical building service engineers in Malaysia always design the centralized air-conditioning system with a temperature set point of 24.0^{o}C. Thus, energy could be saved if the set point is to be increased accordingly for the hospitals, office buildings and lecture halls.

According to the study presented by Masjuki *et al.* (2001), the estimated electricity usage in Malaysia in the year 2011 is 120,287 GWh. In addition, the air conditioners are found to be the major energy users, accounting for 57% of the total electricity consumption (0.57 x 120,287 GWh = 68,563.59 GWh) (Saidur, 2009). Various studies have been conducted to determine the potential energy reduction when increasing the set point temperature of air-conditioners (Atthajariyakul & Leephakpreeda, 2004; Kongkiatumpai, 1999; Saidur, 2009). It was found that a 1°C increase in the temperature of the air-conditioner accounts for about 6% savings in the energy consumption (Atthajariyakul & Leephakpreeda, 2004; Atthajariyakul & Lertsatittanakorn, 2008).

A simple calculation on the potential energy saving for hospitals, offices and lecture halls based on the energy consumption in year 2011 in Malaysia is shown in Table 8.1. Assuming the price of electricity in Malaysia is RM0.312/kWh (≈USD0.103/kWh at an exchange rate of 0.33), the potential cost saving for the commercial building in Malaysia is also shown in Table 8.1 (Tenaga Nasional Berhad, 2012).

Table 8.1 : Potential energy saving for buildings in Malaysia.

	Hospitals	Offices	Lecture Halls
Neutral temperature	26.4°C	24.1°C	25.7°C
Typical design temperature by local engineers	24.0°C	24.0°C	24.0°C
Temperature difference	26.4°C - 24.0°C = 2.4°C	24.1°C - 24.0°C = 0.1°C	25.7°C - 24.0°C = 1.7°C
Percentage of energy saved	2.4°C x 6% = 14.4%	0.1°C x 6% = 0.6%	1.7°C x 6% = 10.2%
Potential energy saving	14.4% x 68,563.59 GWh = 9873.16 GWh/year	0.6% x 68,563.59 GWh = 411.38 GWh/year	10.2% x 68,563.59 GWh = 6993.49 GWh/year
Potential cost saving	9873.16 x 10^6 kWh/year x RM 0.312/kWh = RM 3080 million/year ≈USD 1016 million/year	411.38 x 10^6 kWh/year x RM 0.312/kWh = RM 128.4 million/year ≈USD 42.4 million/year	6993.49 x 10^6 kWh/year x RM 0.312/kWh = RM 2182 million/year ≈USD720.1 million/year

By implementing the new temperature setting in an air-conditioning system, the energy that could be saved is 14.4% for the hospitals, 0.6% for the offices and 10.2% for the lecture halls. Even though the office buildings record the lowest percentage of energy saving, it still accounts for a significant amount of money on a long term basis. From Table 8.1, it is estimated that a minimum of 128.4 million Ringgit Malaysia (≈USD 42.4 million) can be saved annually if the temperature set point is increased to the minimum recommended neutral temperature found in the offices. Besides the cost savings, the greenhouse gas emissions can also be reduced if the energy consumption is reduced.

The conclusions and recommendations will be described in the next chapter.

Chapter 9 Conclusions and Recommendations

The previous chapters have presented the development of the adaptive thermal comfort models from field work study in the hospitals, office buildings and lecture halls. It should be noted again that in this research, the proposed adaptive thermal comfort models give significant contributions to the air-conditioning systems in the tropics, especially in Malaysia. The key benefits from the proposed adaptive models are the optimization of both the energy savings and the thermal comfort levels of occupants.

In conclusions, the objectives of this research study have been achieved and are shown as below:

a) The correlations between the operative temperature and the clothing insulation, the activity level and the air velocity have been successfully developed for hospitals, offices and lecture halls in Kuala Lumpur and Selangor.

b) The acceptable operative temperature for an actual percentage dissatisfied below 20% for the hospitals, offices and lecture halls are 23.7-27.7^{o}C, 23.3-25.2 ^{o}C and 23.9-26.0 ^{o}C, respectively.

c) The neutral temperature found based on the actual mean vote for the hospital personnel, office workers and tertiary students are 26.4^{o}C, 24.1^{o}C and 25.7 ^{o}C, respectively.

d) The adaptive thermal comfort models have been successfully established for the buildings in Malaysia. The adaptive models together with their upper and lower limits of the outdoor temperatures are:

$T_n = 0.3314\ T_{out} + 14.858$, $25.4 < T_{out} < 35.0\ ^{o}C$ for hospitals,

$T_n = 0.1331\ T_{out} + 20.492$, $21.1 < T_{out} < 35.4\ ^{o}C$ for offices,

$T_n = 0.275\ T_{out} + 16.487$, $27.0 < T_{out} < 34.6\ ^{o}C$ for lecture halls.

These adaptive models are the linear regression models since the residual analysis has proven that the residual plots behave randomly.

e) The errors between the neutral temperature found from the developed adaptive models and the experimental chamber are 1.36 %, 0.53 % and 0.96 % for the hospitals, office buildings and lecture halls, respectively.

f) The results obtained in this study has been compared and discussed in Chapter 7.

g) The estimated energy savings and the cost savings by increasing the air-conditioning temperature set point to the recommended neutral temperature are:

14.4 % and RM 3080 million/year	for hospitals,
0.6 % and RM 128.4 million/year	for office buildings,
10.2 % and RM 2182 million/year	for lecture halls.

Based on all the results mentioned above, it can be concluded that the adaptive thermal comfort models are different for different types of buildings in different climates. Furthermore, the neutral temperature found from this research study are important as it could save energy and money used in the air-conditioning systems. Finally, it is a great step to stop climate change by saving the earth, especially in the tropics.

9.1 Recommendations for future work

There are some recommendations that could be carried out in the future in order to enhance the adaptive thermal comfort models in Malaysia. The suggestions are:

a) The field survey can be conducted in other types of buildings such as museums, libraries, factories, shopping malls, cinemas, indoor stadiums, airport’s arrival and departure halls. Different kind of buildings with different thermal requirements will give different adaptive thermal comfort models and comfort temperatures.

b) Verifications should be done in the real buildings instead of a chamber. This is because thermal adaptation is studying people in their natural environment and observe them in their everyday life. Thus, the adaptive thermal comfort models developed from the real building's data should also be verified in real buildings.

c) In the present research, the study was only conducted in the Federal Territory of Kuala Lumpur and Selangor state. Note that Malaysia consists of three federal territories and thirteen states. In order to have a substantial field survey data, research should be conducted in all the federal territories and states in Malaysia.

d) The ASHRAE Thermal Comfort Tool was used to calculate PMV and PPD in this research. The tool is Version 1 software which was launched in year 1995. The most recent ASHRAE Thermal Comfort Tool, Version 2 was launched in September 2011. This newly launched software is based on the ANSI/ASHRAE Standard 55-2010, Thermal Environmental Conditions for Human Occupancy. It is recommended for future researchers to buy and utilize the Version 2 software in order to get a more reliable calculation of PMV and PPD.

e) Generally, the main occupants in hospitals are patients and staff. In this thesis, study has been focused on staff only. Since patient's thermal requirement is different from staff, it is important to have a balance condition so that all occupants are satisfied with their surrounding environment. In order to achieve this condition, a VAV system is recommended to be installed in the air-conditioning ducting structure to diffuse different supply air temperatures to the patient and staff allocation areas. Hence, it is suggested for future researchers to conduct a study on patients in hospitals to obtain their neutral temperature according to their health conditions.

List of Publications

- **Journal**

1. Yau, Y. H., & Chew, B. T. A review on PMV and adaptive thermal comfort models. Building Services Engineering Research & Technology (BSERT). The revised manuscript has been sent to the Journal Editor for the final review and approval to be accepted for publication in BSERT.
   (*ISI/SCOPUS Cited Publication*)

2. Yau, Y. H., & Chew, B. T. Adaptive thermal comfort model for air-conditioned hospitals in Malaysia. Building Services Engineering Research & Technology (BSERT). The revised manuscript has been sent to the Journal Editor for the final review and approval to be accepted for publication in BSERT.
   (*ISI/SCOPUS Cited Publication*)

3. Yau, Y. H., & Chew, B. T. (2009). Thermal comfort study of hospital workers in Malaysia. *International Journal of Indoor Air*, 19(6), 500-510.
   (*ISI/SCOPUS Cited Publication*)

- **Proceedings**

1. Yau, Y. H., & Chew, B. T. (2011). A field study on thermal comfort in lecture halls in Malaysia. In *Institute of Heating, Ventilating & Air Conditioning Engineering Conference (ISHVAC2011)*. Shanghai, China.

   (ISI/SCOPUS Cited Publication)

2. Yau, Y. H., & Chew, B. T. (2010). The study of activity rates and thermal comfort of office occupants in the tropics. In *UK-Malaysian-Ireland Symposium 2010 (UMIES 2010)*. Queen's University, Belfast, Ireland.

   (ISI/SCOPUS Cited Publication)

3. Yau, Y. H., Chew, B. T., & Yau, C. S. (2009). Adaptive thermal comfort model study in the tropics. In *Proceedings of World Renewable Energy Congress 2009 Asia* (pp. 1386-1391). Bangkok, Thailand.

   (ISI Indexed).

Appendices

Appendix A : Sample Questionnaire

<u>THERMAL ENVIRONMENT SURVEY</u>

This survey is part of a study to evaluate the current thermal conditions of the selected building. We appreciate your feedback in this evaluation. Please tick at the square box where applicable.

1. Gender: Male ☐ Female ☐
2. Age :
3. Occupant location:
4. Occupant's Clothing *Please refer to the attached Table 1. Place a check mark next to the articles of clothing that you are currently wearing as you fill out this sheet. If you are wearing articles of clothing not listed in the table, please enter them into the space provided below.* Clothing:
5. Occupant Activity Level *(Tick the one that is most suitable)* Seated quite/writing, 1.0met ☐ Walking about, 1.7met ☐ Typing, 1.1met ☐ Lifting/packing, 2.1met ☐ Standing relaxed/Filing(seated), 1.2met ☐ Light machine work, 2.2met ☐ Filing(standing), 1.4met ☐ Heavy machine work, 4.0met ☐
6. How would you describe your typical level of thermal sensation? +3 Hot ☐ -1 Slightly Cool ☐ +2 Warm ☐ -2 Cool ☐ +1 Slightly Warm ☐ -3 Cold ☐ 0 Neutral ☐

Clothing Ensembles

Description	
Trousers, short-sleeve shirt	
Trousers, long-sleeve shirt	
Trousers, long-sleeve shirt plus suit jacket	
Trousers, long-sleeve shirt plus suit jacket, vest, T-shirt	
Trousers, long-sleeve shirt plus long sleeve sweater, T-shirt	
Trousers, long-sleeve shirt plus long sleeve sweater, T-shirt plus suit jacket, long underwear bottoms	
Knee-length skirt, short sleeve-shirt (sandals)	
Knee-length skirt, long sleeve-shirt, full slip	
Knee-length skirt, long sleeve-shirt, half slip, long-sleeve sweater	
Angle-length skirt, long-sleeve shirt, suit jacket	
Walking-shorts, short-sleeve shirt	
Long-sleeve coveralls, T-shirt	
Overalls, long-sleeve shirt, T-shirt	
Insulated coveralls, long-sleeve thermal underwear tops and bottoms	
Sweat pants, sweat shirt	

Appendix B : Table of Clothing Value

Table 8 Garment Insulation Values

Garment Description[a]	$I_{clu,i}$, clo[b]	Garment Description[a]	$I_{clu,i}$, clo[b]	Garment Description[a]	$I_{clu,i}$, clo[b]
Underwear		Long-sleeved, flannel shirt	0.34	Long-sleeved (thin)	0.25
Men's briefs	0.04	Short-sleeved, knit sport shirt	0.17	Long-sleeved (thick)	0.36
Panties	0.03	Long-sleeved, sweat shirt	0.34	**Dresses and skirts[c]**	
Bra	0.01	**Trousers and Coveralls**		Skirt (thin)	0.14
T-shirt	0.08	Short shorts	0.06	Skirt (thick)	0.23
Full slip	0.16	Walking shorts	0.08	Long-sleeved shirtdress (thin)	0.33
Half slip	0.14	Straight trousers (thin)	0.15	Long-sleeved shirtdress (thick)	0.47
Long underwear top	0.20	Straight trousers (thick)	0.24	Short-sleeved shirtdress (thin)	0.29
Long underwear bottoms	0.15	Sweatpants	0.28	Sleeveless, scoop neck (thin)	0.23
Footwear		Overalls	0.30	Sleeveless, scoop neck (thick)	0.27
Ankle-length athletic socks	0.02	Coveralls	0.49	**Sleepwear and Robes**	
Calf-length socks	0.03	**Suit jackets and vests (lined)**		Sleeveless, short gown (thin)	0.18
Knee socks (thick)	0.06	Single-breasted (thin)	0.36	Sleeveless, long gown (thin)	0.20
Panty hose	0.02	Single-breasted (thick)	0.44	Short-sleeved hospital gown	0.31
Sandals/thongs	0.02	Double-breasted (thin)	0.42	Long-sleeved, long gown (thick)	0.46
Slippers (quilted, pile-lined)	0.03	Double-breasted (thick)	0.48	Long-sleeved pajamas (thick)	0.57
Boots	0.10	Sleeveless vest (thin)	0.10	Short-sleeved pajamas (thin)	0.42
Shirts and Blouses		Sleeveless vest (thick)	0.17	Long-sleeved, long wrap robe (thick)	0.69
Sleeveless, scoop-neck blouse	0.12	**Sweaters**		Long-sleeved, short wrap robe (thick)	0.48
Short-sleeved, dress shirt	0.19	Sleeveless vest (thin)	0.13	Short-sleeved, short robe (thin)	0.34
Long-sleeved, dress shirt	0.25	Sleeveless vest (thick)	0.22		

[a]"Thin" garments are summerweight; "thick" garments are winterweight. [b]1 clo = 0.155 ($m^2 \cdot K$)/W [c]Knee-length

Appendix C : Table of Metabolic Rate

Table 4 Typical Metabolic Heat Generation for Various Activities

	W/m^2	met*
Resting		
Sleeping	40	0.7
Reclining	45	0.8
Seated, quiet	60	1.0
Standing, relaxed	70	1.2
Walking (on level surface)		
3.2 km/h (0.9 m/s)	115	2.0
4.3 km/h (1.2 m/s)	150	2.6
6.4 km/h (1.8 m/s)	220	3.8
Office Activities		
Reading, seated	55	1.0
Writing	60	1.0
Typing	65	1.1
Filing, seated	70	1.2
Filing, standing	80	1.4
Walking about	100	1.7
Lifting/packing	120	2.1
Driving/Flying		
Car	60 to 115	1.0 to 2.0
Aircraft, routine	70	1.2
Aircraft, instrument landing	105	1.8
Aircraft, combat	140	2.4
Heavy vehicle	185	3.2
Miscellaneous Occupational Activities		
Cooking	95 to 115	1.6 to 2.0
Housecleaning	115 to 200	2.0 to 3.4
Seated, heavy limb movement	130	2.2
Machine work		
sawing (table saw)	105	1.8
light (electrical industry)	115 to 140	2.0 to 2.4
heavy	235	4.0
Handling 50 kg bags	235	4.0
Pick and shovel work	235 to 280	4.0 to 4.8
Miscellaneous Leisure Activities		
Dancing, social	140 to 255	2.4 to 4.4
Calisthenics/exercise	175 to 235	3.0 to 4.0
Tennis, singles	210 to 270	3.6 to 4.0
Basketball	290 to 440	5.0 to 7.6
Wrestling, competitive	410 to 505	7.0 to 8.7

Sources: Compiled from various sources. For additional information, see Buskirk (1960), Passmore and Durnin (1967), and Webb (1964).
*1 met = 58.1 W/m^2

Appendix D : Detail measurements for hospitals

Table D1 : Measurements of air temperature at Pharmacy, UMMC.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Pharmacy	1	22.5	22.1	22.3	22.3	22.3
	2	22.4	22.5	22.4	22.3	22.4
	3	22.8	22.6	22.9	22.5	22.7
	4	22.4	22.1	21.5	21.9	22.0
	5	21.8	21.6	21.9	21.9	21.8
	6	21.8	21.9	22.1	22.0	21.9
	7	22.3	21.9	22.1	22.6	22.2
	8	22.9	22.0	22.1	22.1	22.3
	9	22.1	22.2	22.0	22.0	22.1
	Total average					22.2

Table D2 : Measurements of air temperature at Otorinolaringologi, UMMC.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Otorinolaringologi	1	22.9	22.5	22.4	22.2	22.5
	2	23.0	23.0	22.7	22.9	22.9
	3	22.6	23.1	23.0	23.0	22.9
	4	22.6	22.8	22.9	23.0	22.8
	5	22.6	22.6	22.3	22.3	22.5
	6	22.7	22.8	22.9	22.9	22.8
	7	23.0	22.6	22.5	22.3	22.6
	8	22.5	22.5	22.2	22.4	22.4
	Total average					22.7

Table D3 : Measurements of air temperature at Oftalmologi, UMMC.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Oftalmologi	1	22.7	21.8	21.9	21.9	22.1
	2	22.3	22.4	22.3	22.2	22.3
	3	22.1	21.9	22.2	21.8	22.0
	4	22.5	22.2	21.6	22.0	22.1
	5	23.0	22.9	23.2	23.2	23.1
	6	23.2	23.3	23.5	23.5	23.3
	7	23.5	23.1	23.2	23.8	23.4
	8	23.9	23.0	23.1	23.1	23.3
	9	22.8	22.9	22.8	22.6	22.8
	Total average					22.7

Table D4 : Measurements of air temperature at Emergency Consultation Hall, UMMC.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Emergency Consultation Hall	1	23.5	23.1	23.0	22.8	23.1
	2	21.7	21.7	21.5	21.6	21.6
	3	21.1	21.5	21.4	21.4	21.3
	4	20.6	20.8	20.9	21.0	20.8
	5	20.9	20.9	20.7	20.6	20.8
	6	20.4	20.5	20.6	20.6	20.5
	7	20.7	20.5	20.4	20.3	20.5
	8	20.6	20.6	20.4	20.5	20.5
	9	20.1	20.4	20.3	20.3	20.3
	Total average					21.0

Table D5 : Measurements of air temperature at Observation ward, UMMC.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Observation ward	1	21.1	20.2	20.3	20.3	20.5
	2	20.4	20.5	20.3	20.2	20.4
	3	20.6	20.4	20.7	20.3	20.5
	4	20.7	20.5	19.9	20.3	20.4
	5	20.3	20.1	20.4	20.4	20.3
	6	20.1	20.2	20.4	20.3	20.2
	7	20.3	20.0	20.1	20.6	20.2
	8	20.9	20.0	20.1	20.1	20.3
	9	20.1	20.2	20.0	19.9	20.1
	Total average					20.3

Table D6 : Measurements of globe temperature at Pharmacy, UMMC.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Pharmacy	1	23.4	22.7	23.0	23.0	23.0
	2	22.8	23.1	22.9	23.1	23.0
	3	23.0	22.9	23.3	23.3	23.1
	4	23.4	23.4	22.9	23.3	23.2
	5	22.9	22.9	23.3	23.6	23.2
	6	22.9	22.9	23.4	23.7	23.2
	7	23.2	23.0	23.2	23.8	23.3
	8	23.6	22.9	23.2	23.2	23.2
	9	23.1	23.4	23.2	23.4	23.3
	Total average					23.2

Table D7 : Measurements of globe temperature at Otorinolaringologi, UMMC.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Otorinolaringologi	1	22.0	22.4	22.7	22.9	22.5
	2	22.2	22.5	22.6	22.7	22.5
	3	22.2	22.4	22.6	23.0	22.6
	4	22.7	22.7	22.6	22.9	22.7
	5	22.3	22.5	22.9	23.1	22.7
	6	22.5	22.8	22.8	22.8	22.8
	7	22.3	22.7	23.0	23.2	22.8
	8	22.6	22.9	23.0	23.1	22.9
	Total average					22.7

Table D8 : Measurements of globe temperature at Oftalmologi, UMMC.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Oftalmologi	1	22.6	21.9	22.2	22.2	22.2
	2	22.1	22.4	22.2	22.4	22.3
	3	22.3	22.2	22.6	22.6	22.4
	4	22.5	22.5	22.0	22.4	22.3
	5	22.1	22.1	22.5	22.8	22.4
	6	22.1	22.1	22.6	22.9	22.4
	7	22.4	22.2	22.4	23.0	22.5
	8	22.9	22.2	22.5	22.5	22.5
	9	22.4	22.7	22.5	22.7	22.6
	Total average					22.4

Table D9 : Measurements of globe temperature at Emergency Consultation Hall, UMMC.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Emergency Consultation Hall	1	22.4	22.8	23.1	23.3	22.9
	2	22.5	22.8	22.9	23.0	22.8
	3	22.3	22.5	22.7	23.1	22.7
	4	22.5	22.5	22.4	22.7	22.5
	5	22.0	22.2	22.6	22.8	22.4
	6	22.0	22.3	22.4	22.3	22.3
	7	21.8	22.2	22.5	22.7	22.3
	8	22.1	22.4	22.5	22.6	22.4
	9	21.9	22.1	22.3	22.7	22.3
	Total average					22.5

Table D10 : Measurements of globe temperature at Observation ward, UMMC.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Observation ward	1	21.8	21.1	21.4	21.4	21.4
	2	21.2	21.5	21.3	21.5	21.4
	3	21.3	21.2	21.6	21.6	21.4
	4	21.6	21.6	21.1	21.5	21.4
	5	21.2	21.2	21.6	21.9	21.5
	6	21.1	21.1	21.6	21.9	21.4
	7	21.4	21.2	21.4	21.9	21.4
	8	21.8	21.1	21.4	21.4	21.4
	9	21.1	21.4	21.2	21.4	21.3
	Total average					21.4

Table D11 : Measurements of air velocity at Pharmacy, UMMC.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Pharmacy	1	0.04	0.15	0.10	0.11	0.10
	2	0.14	0.09	0.07	0.09	0.10
	3	0.04	0.07	0.15	0.14	0.10
	4	0.13	0.18	0.16	0.26	0.18
	5	0.16	0.19	0.20	0.18	0.18
	6	0.10	0.10	0.14	0.21	0.14
	7	0.13	0.09	0.11	0.08	0.10
	8	0.09	0.13	0.11	0.18	0.13
	9	0.16	0.19	0.20	0.18	0.18
	Total average					0.13

Table D12 : Measurements of air velocity at Otorinolaringologi, UMMC.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Otorinolaringologi	1	0.03	0.09	0.05	0.06	0.06
	2	0.09	0.11	0.10	0.11	0.10
	3	0.06	0.06	0.06	0.06	0.06
	4	0.05	0.07	0.07	0.08	0.07
	5	0.05	0.06	0.07	0.06	0.06
	6	0.06	0.07	0.07	0.11	0.08
	7	0.13	0.10	0.11	0.09	0.11
	8	0.05	0.06	0.06	0.06	0.06
	Total average					0.07

Table D13 : Measurements of air velocity at Oftalmologi, UMMC.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Oftalmologi	1	0.08	0.17	0.10	0.12	0.12
	2	0.12	0.14	0.13	0.14	0.13
	3	0.12	0.13	0.13	0.12	0.13
	4	0.10	0.13	0.12	0.14	0.12
	5	0.05	0.06	0.07	0.06	0.06
	6	0.10	0.10	0.12	0.15	0.12
	7	0.07	0.05	0.06	0.05	0.06
	8	0.05	0.07	0.06	0.07	0.06
	9	0.12	0.13	0.13	0.12	0.13
	Total average					0.10

Table D14 : Measurements of air velocity at Emergency Consultation Hall, UMMC.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Emergency Consultation Hall	1	0.03	0.09	0.05	0.06	0.06
	2	0.13	0.15	0.14	0.15	0.14
	3	0.06	0.06	0.06	0.06	0.06
	4	0.11	0.15	0.14	0.17	0.14
	5	0.07	0.08	0.09	0.08	0.08
	6	0.08	0.09	0.09	0.13	0.10
	7	0.16	0.12	0.14	0.12	0.14
	8	0.12	0.14	0.13	0.14	0.13
	9	0.10	0.11	0.11	0.10	0.11
	Total average					0.11

Table D15 : Measurements of air velocity at Observation ward, UMMC.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Observation ward	1	0.08	0.17	0.10	0.12	0.12
	2	0.10	0.13	0.12	0.13	0.12
	3	0.09	0.10	0.10	0.09	0.10
	4	0.11	0.15	0.14	0.17	0.14
	5	0.11	0.13	0.15	0.13	0.13
	6	0.06	0.07	0.07	0.11	0.08
	7	0.11	0.08	0.09	0.07	0.09
	8	0.07	0.09	0.08	0.09	0.08
	9	0.15	0.16	0.16	0.15	0.16
	Total average					0.11

Table D16 : Measurements of relative humidity at Pharmacy, UMMC.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Pharmacy	1	65.5	69.8	70.7	71.3	69.3
	2	69.9	69.3	69.3	68.6	69.3
	3	70.5	69.9	70.2	70.2	70.2
	4	69.9	70.0	70.2	71.9	70.5
	5	70.0	68.8	72.7	72.8	71.1
	6	74.2	73.3	73.0	72.7	73.3
	7	84.1	80.4	72.1	79.8	79.1
	8	81.6	80.6	80.3	80.0	80.6
	9	89.6	85.7	76.9	85.1	84.3
	Total average					74.2

Table D17 : Measurements of relative humidity at Otorinolaringologi, UMMC.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Otorinolaringologi	1	85.8	85.6	85.8	85.7	85.7
	2	80.0	79.8	76.3	72.8	77.2
	3	73.8	73.4	73.9	73.8	73.7
	4	73.7	74.3	73.9	73.6	73.9
	5	74.0	74.9	75.3	75.1	74.8
	6	76.3	76.1	75.9	75.3	75.9
	7	75.6	75.7	75.7	75.7	75.7
	8	71.8	72.7	73.1	72.9	72.6
	Total average					76.2

Table D18 : Measurements of relative humidity at Oftalmologi, UMMC.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Oftalmologi	1	74.5	74.3	74.5	74.4	74.4
	2	76.2	76.0	72.7	69.3	73.5
	3	73.8	73.4	73.9	73.8	73.7
	4	75.2	75.8	75.4	75.1	75.4
	5	78.4	79.3	79.7	79.6	79.2
	6	72.3	72.1	71.9	71.3	71.9
	7	72.8	72.9	72.9	72.9	72.9
	8	70.9	71.7	72.1	71.9	71.6
	9	71.9	71.7	71.5	70.9	71.5
	Total average					73.8

Table D19 : Measurements of relative humidity at Emergency Consultation Hall, UMMC.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Emergency Consultation Hall	1	62.8	66.9	67.8	68.4	66.5
	2	70.3	69.7	69.7	69.0	69.7
	3	71.9	71.3	71.6	71.6	71.6
	4	73.5	73.6	73.8	75.6	74.1
	5	72.6	71.4	75.5	75.6	73.8
	6	76.4	75.4	75.1	74.8	75.4
	7	80.5	76.9	69.0	76.4	75.7
	8	76.5	75.5	75.2	74.9	75.5
	9	80.0	76.5	68.7	76.0	75.3
	Total average					73.1

Table D20 : Measurements of relative humidity at Observation ward, UMMC.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
UMMC - Observation ward	1	70.8	75.4	76.4	77.0	74.9
	2	76.4	75.7	75.7	75.0	75.7
	3	75.4	74.8	75.1	75.1	75.1
	4	74.7	74.9	75.1	76.9	75.4
	5	74.1	72.9	77.0	77.1	75.3
	6	76.4	75.4	75.1	74.8	75.4
	7	80.5	76.9	69.0	76.4	75.7
	8	76.5	75.5	75.2	74.9	75.5
	9	80.5	76.9	69.0	76.4	75.7
	Total average					75.4

Table D21 : Measurements of metabolic rate at Pharmacy, UMMC.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
UMMC - Pharmacy	Seated quiet	1.0	2	2.0	
	Typing	1.1	6	6.6	
	Standing relaxed	1.2	5	6.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	7	11.9	
	Total		20	26.5	1.33

Table D22 : Measurements of metabolic rate at Otorinolaringologi, UMMC.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
UMMC - Otorinolaringologi	Seated quiet	1.0	11	11.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	4	4.8	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	4	6.8	
	Total		20	24.0	1.20

Table D23 : Measurements of metabolic rate at Oftalmologi, UMMC.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
UMMC - Oftalmologi	Seated quiet	1.0	15	15.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	4	4.8	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	1	1.7	
	Total		20	21.5	1.08

Table D24 : Measurements of metabolic rate at Emergency Consultation Hall, UMMC.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
UMMC - Emergency Consultation Hall	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	7	8.4	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	2	3.4	
	Total		10	13.2	1.32

Table D25 : Measurements of metabolic rate at Observation ward, UMMC.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
UMMC - Observation ward	Seated quiet	1.0	9	9.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	5	8.5	
	Total		16	20.1	1.26

Table D26 : Measurements of clothing value at Pharmacy, UMMC.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
UMMC - Pharmacy	Short-sleeve	0.19	6	1.14	
	Normal long-sleeve shirt	0.25	14	3.50	
	Normal trousers	0.15	20	3.00	
	Socks	0.02	20	0.40	
	Shoes	0.02	20	0.40	
	Jacket	0.36	15	5.40	
	Total		20	13.84	0.69

Table D27 : Measurements of clothing value at Otorinolaringologi, UMMC.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
UMMC - Otorinolaringologi	Short-sleeve	0.19	11	2.09	
	Normal long-sleeve shirt	0.25	9	2.25	
	Normal trousers	0.15	20	3.00	
	Socks	0.02	20	0.40	
	Shoes	0.02	20	0.40	
	Jacket	0.36	4	1.44	
	Total		20	9.58	0.48

Table D28 : Measurements of clothing value at Oftalmologi, UMMC.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
UMMC - Oftalmologi	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	16	4.00	
	Normal trousers	0.15	20	3.00	
	Socks	0.02	20	0.40	
	Shoes	0.02	20	0.40	
	Jacket	0.36	5	1.80	
	Total		20	10.36	0.52

Table D29 : Measurements of clothing value at Emergency Consultation Hall, UMMC.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
UMMC - Emergency Consultation Hall	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	10	2.50	
	Normal trousers	0.15	10	1.50	
	Socks	0.02	10	0.20	
	Shoes	0.02	10	0.20	
	Jacket	0.36	1	0.36	
	Total		10	4.76	0.48

Table D30 : Measurements of clothing value at Observation ward, UMMC.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
UMMC - Observation ward	Short-sleeve	0.19	12	2.28	
	Normal long-sleeve shirt	0.25	4	1.00	
	Normal trousers	0.15	16	2.40	
	Socks	0.02	16	0.32	
	Shoes	0.02	16	0.32	
	Jacket	0.36	1	0.36	
	Total		16	6.68	0.42

Table D31 : Measurements of AMV at Pharmacy, UMMC.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
UMMC - Pharmacy	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	10	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	3	-6.0	
	Cold	-3	2	-6.0	
	Total		20	-15.0	-0.75

Table D32 : Measurements of AMV at Otorinolaringologi, UMMC.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
UMMC - Otorinolaringologi	Hot	3	0	0.0	
	Warm	2	2	4.0	
	Slightly warm	1	0	0.0	
	Neutral	0	6	0.0	
	Slightly cool	-1	8	-8.0	
	Cool	-2	3	-6.0	
	Cold	-3	1	-3.0	
	Total		20	-13.0	-0.65

Table D33 : Measurements of AMV at Oftalmologi, UMMC.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
UMMC - Oftalmologi	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	3	3.0	
	Neutral	0	4	0.0	
	Slightly cool	-1	7	-7.0	
	Cool	-2	2	-4.0	
	Cold	-3	4	-12.0	
	Total		20	-20.0	-1.00

Table D34 : Measurements of AMV at Emergency Consultation Hall, UMMC.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
UMMC - Emergency Consultation Hall	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	7	-7.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		10	-9.0	-0.90

Table D35 : Measurements of AMV at Observation ward, UMMC.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
UMMC - Observation ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	3	0.0	
	Slightly cool	-1	8	-8.0	
	Cool	-2	3	-6.0	
	Cold	-3	1	-3.0	
	Total		16	-16.0	-1.00

Table D36 : Measurements of air temperature at Pediatric ward, Putrajaya.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pediatric ward	1	24.5	24.1	24.0	23.8	24.1
	2	24.2	24.2	23.9	24.1	24.1
	3	23.9	24.4	24.3	24.3	24.2
	4	23.8	24.1	24.2	24.3	24.1
	5	24.1	24.1	23.8	23.8	24.0
	Total average					24.1

Table D37 : Measurements of air temperature at Orthopedic ward, Putrajaya.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Orthopedic ward	1	23.9	23.9	23.6	23.5	23.7
	2	23.2	23.6	23.8	23.9	23.6
	3	23.5	23.5	23.2	23.3	23.4
	4	23.2	23.3	23.3	23.3	23.3
	5	23.2	23.1	23.2	23.3	23.2
	6	23.0	23.2	23.2	23.1	23.1
	7	23.2	23.2	23.0	22.9	23.1
	Total average					23.3

Table D38 : Measurements of air temperature at Female medical ward, Putrajaya.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Female medical ward	1	23.5	23.5	23.2	23.1	23.3
	2	22.9	23.3	23.5	23.6	23.3
	3	23.5	23.5	23.2	23.3	23.4
	4	23.3	23.4	23.4	23.4	23.4
	5	23.4	23.3	23.4	23.5	23.4
	6	23.2	23.4	23.4	23.3	23.3
	7	23.4	23.4	23.2	23.1	23.3
	Total average					23.3

Table D39 : Measurements of air temperature at Pharmacy, Putrajaya.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pharmacy	1	22.9	22.0	22.1	22.1	22.3
	2	22.8	22.9	22.7	22.7	22.8
	3	22.8	22.6	22.9	22.5	22.7
	4	22.9	22.6	22.0	22.4	22.5
	5	22.3	22.1	22.4	22.4	22.3
	Total average					22.5

Table D40 : Measurements of air temperature at X-ray & radiography, Putrajaya.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - X-ray & radiography	1	21.6	21.9	21.8	21.8	21.8
	2	21.3	21.5	21.6	22.0	21.6
	3	21.2	21.0	21.3	21.0	21.1
	4	21.3	21.0	21.0	20.8	21.0
	5	21.1	21.2	21.2	21.3	21.2
	Total average					21.3

Table D41 : Measurements of air temperature at Out-patient pharmacy, Putrajaya.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Out-patient pharmacy	1	23.0	22.0	22.1	22.1	22.3
	2	22.2	22.3	22.2	22.0	22.2
	3	22.6	22.4	22.7	22.3	22.5
	4	22.1	21.9	21.3	21.7	21.8
	5	22.2	22.0	22.3	22.3	22.2
	Total average					22.2

Table D42 : Measurements of air temperature at Day care unit, Putrajaya.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Day care unit	1	22.4	21.5	21.6	21.6	21.8
	2	22.1	22.2	22.0	22.0	22.1
	3	21.9	21.7	22.0	21.6	21.8
	4	21.5	21.3	20.7	21.1	21.2
	5	22.0	21.8	22.1	22.1	22.0
	Total average					21.8

Table D43 : Measurements of globe temperature at Pediatric ward, Putrajaya.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pediatric ward	1	23.7	23.8	24.1	24.4	24.0
	2	24.2	24.3	23.3	24.6	24.1
	3	23.5	24.0	24.4	24.6	24.1
	4	24.6	22.9	23.8	25.4	24.2
	5	24.0	24.1	24.2	23.9	24.1
	Total average					24.1

Table D44 : Measurements of globe temperature at Orthopedic ward, Putrajaya.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Orthopedic ward	1	23.0	23.1	23.4	23.7	23.3
	2	23.3	23.4	22.5	23.7	23.2
	3	22.5	23.0	23.4	23.6	23.1
	4	23.5	21.8	22.7	24.2	23.1
	5	23.1	23.2	23.3	23.0	23.2
	6	22.7	23.2	23.2	23.4	23.1
	7	23.0	23.1	23.4	23.7	23.3
	Total average					23.2

Table D45 : Measurements of globe temperature at Female medical ward, Putrajaya.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Female medical ward	1	23.6	23.8	23.5	23.5	23.6
	2	24.3	24.8	25.3	25.3	24.9
	3	25.8	26.0	25.9	26.0	25.9
	4	25.8	26.0	26.3	26.3	26.1
	5	26.1	26.2	26.4	26.6	26.3
	6	25.8	26.2	26.3	26.3	26.1
	7	25.9	26.1	26.5	26.4	26.2
	Total average					25.6

Table D46 : Measurements of globe temperature at Pharmacy, Putrajaya.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pharmacy	1	22.1	22.1	22.3	22.5	22.3
	2	23.0	23.0	23.1	23.1	23.0
	3	22.2	22.3	22.5	22.7	22.4
	4	22.0	22.0	22.2	22.3	22.1
	5	22.6	22.6	22.4	22.7	22.6
	Total average					22.5

Table D47 : Measurements of globe temperature at X-ray & radiography, Putrajaya.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - X-ray & radiography	1	21.0	20.9	21.1	21.4	21.1
	2	21.6	21.6	21.4	21.8	21.6
	3	21.3	21.3	21.4	21.4	21.3
	4	20.7	21.3	21.5	21.6	21.3
	5	21.1	21.3	21.6	21.7	21.4
	Total average					21.3

Table D48 : Measurements of globe temperature at Out-patient pharmacy, Putrajaya.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Out-patient pharmacy	1	22.0	22.0	22.2	22.4	22.2
	2	22.1	22.1	22.3	22.4	22.2
	3	22.4	22.5	22.7	22.9	22.6
	4	21.8	21.8	22.0	22.1	21.9
	5	22.3	22.3	22.0	22.4	22.2
	Total average					22.2

Table D49 : Measurements of globe temperature at Day care unit, Putrajaya.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Day care unit	1	21.6	21.5	21.7	22.0	21.7
	2	22.1	22.1	21.9	22.3	22.1
	3	21.8	21.8	22.0	22.0	21.9
	4	20.6	21.2	21.4	21.6	21.2
	5	21.8	22.0	22.3	22.5	22.1
	Total average					21.8

Table D50 : Measurements of air velocity at Pediatric ward, Putrajaya.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pediatric ward	1	0.06	0.09	0.06	0.06	0.07
	2	0.05	0.05	0.05	0.05	0.05
	3	0.02	0.04	0.08	0.07	0.05
	4	0.06	0.08	0.07	0.12	0.08
	5	0.05	0.06	0.07	0.06	0.06
	Total average					0.06

Table D51 : Measurements of air velocity at Orthopedic ward, Putrajaya.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Orthopedic ward	1	0.08	0.13	0.08	0.09	0.10
	2	0.09	0.09	0.08	0.10	0.09
	3	0.06	0.11	0.21	0.20	0.14
	4	0.07	0.10	0.09	0.15	0.10
	5	0.10	0.12	0.13	0.12	0.12
	6	0.07	0.08	0.09	0.11	0.09
	7	0.10	0.12	0.13	0.12	0.12
	Total average					0.11

Table D52 : Measurements of air velocity at Female medical ward, Putrajaya.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Female medical ward	1	0.03	0.05	0.06	0.05	0.05
	2	0.04	0.04	0.06	0.09	0.06
	3	0.03	0.03	0.11	0.16	0.08
	4	0.05	0.08	0.08	0.08	0.07
	5	0.03	0.07	0.08	0.14	0.08
	6	0.08	0.07	0.09	0.11	0.09
	7	0.04	0.05	0.06	0.05	0.05
	Total average					0.07

Table D53 : Measurements of air velocity at Pharmacy, Putrajaya.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pharmacy	1	0.05	0.20	0.12	0.14	0.12
	2	0.19	0.12	0.09	0.11	0.13
	3	0.05	0.11	0.22	0.20	0.15
	4	0.12	0.16	0.15	0.23	0.16
	5	0.16	0.19	0.20	0.18	0.18
	Total average					0.15

Table D54 : Measurements of air velocity at X-ray & radiography, Putrajaya.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - X-ray & radiography	1	0.12	0.29	0.18	0.20	0.20
	2	0.26	0.17	0.13	0.15	0.18
	3	0.09	0.18	0.33	0.32	0.23
	4	0.15	0.20	0.18	0.29	0.20
	5	0.17	0.18	0.19	0.19	0.18
	Total average					0.20

Table D55 : Measurements of air velocity at Out-patient pharmacy, Putrajaya.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Out-patient pharmacy	1	0.23	0.17	0.19	0.15	0.18
	2	0.20	0.13	0.10	0.12	0.14
	3	0.05	0.09	0.19	0.18	0.13
	4	0.12	0.17	0.15	0.25	0.17
	5	0.14	0.17	0.18	0.16	0.16
	Total average					0.16

Table D56 : Measurements of air velocity at Day care unit, Putrajaya.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Day care unit	1	0.14	0.22	0.15	0.15	0.17
	2	0.16	0.16	0.15	0.17	0.16
	3	0.07	0.14	0.27	0.25	0.18
	4	0.15	0.20	0.18	0.29	0.20
	5	0.19	0.22	0.25	0.23	0.22
	Total average					0.19

Table D57 : Measurements of relative humidity at Pediatric ward, Putrajaya.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pediatric ward	1	63.0	64.0	64.6	64.9	64.1
	2	66.5	66.6	63.0	66.3	65.6
	3	65.5	65.9	65.9	64.7	65.5
	4	64.6	62.3	63.7	63.7	63.6
	5	58.2	63.4	62.2	68.2	63.0
	Total average					64.4

Table D58 : Measurements of relative humidity at Orthopedic ward, Putrajaya.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Orthopedic ward	1	56.9	57.8	58.3	58.6	57.9
	2	57.7	57.8	54.7	57.5	56.9
	3	56.6	56.9	57.0	55.9	56.6
	4	57.3	55.3	56.5	56.5	56.4
	5	52.1	56.7	55.7	61.1	56.4
	6	56.5	56.3	56.6	56.9	56.6
	7	57.2	55.2	56.4	56.4	56.3
	Total average					56.7

Table D59 : Measurements of relative humidity at Female medical ward, Putrajaya.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Female medical ward	1	52.1	53.0	48.3	55.8	52.3
	2	53.6	53.5	49.3	56.0	53.1
	3	54.4	54.4	49.2	55.2	53.3
	4	55.6	55.4	49.7	55.3	54.0
	5	56.4	56.0	49.8	55.4	54.4
	6	54.8	54.9	49.8	56.1	53.9
	7	54.8	55.7	50.8	58.7	55.0
	Total average					53.7

Table D60 : Measurements of relative humidity at Pharmacy, Putrajaya.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Pharmacy	1	64.6	68.9	69.8	70.4	68.4
	2	61.6	61.1	61.1	60.5	61.1
	3	64.5	63.9	64.2	64.2	64.2
	4	63.7	63.8	64.0	65.6	64.3
	5	67.2	66.1	69.9	70.0	68.3
	Total average					65.3

Table D61 : Measurements of relative humidity at X-ray & radiography, Putrajaya.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - X-ray & radiography	1	71.9	72.4	72.4	72.4	72.3
	2	62.7	63.7	64.4	63.9	63.7
	3	67.8	68.8	69.1	69.1	68.7
	4	69.4	67.2	68.3	68.7	68.4
	5	68.6	69.2	68.7	68.7	68.8
	Total average					68.4

Table D62 : Measurements of relative humidity at Out-patient pharmacy, Putrajaya.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Out-patient pharmacy	1	46.5	49.5	50.2	50.6	49.2
	2	54.6	54.1	54.1	53.6	54.1
	3	56.9	56.3	56.6	56.6	56.6
	4	55.6	55.7	55.9	57.2	56.1
	5	48.9	48.1	50.8	50.9	49.7
	Total average					53.1

Table D63 : Measurements of relative humidity at Day care unit, Putrajaya.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Putrajaya - Day care unit	1	61.8	62.2	62.4	62.4	62.2
	2	55.2	55.3	55.4	55.4	55.3
	3	54.6	54.4	54.3	53.9	54.3
	4	55.0	55.0	54.8	54.8	54.9
	5	57.9	57.9	57.7	57.4	57.7
	Total average					56.9

Table D64 : Measurements of metabolic rate at Pediatric ward, Putrajaya.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Putrajaya - Pediatric ward	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	6	7.2	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	2	3.4	
	Total		10	13.4	1.34

Table D65 : Measurements of metabolic rate at Orthopedic ward, Putrajaya.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Putrajaya - Orthopedic ward	Seated quiet	1.0	6	6.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	5	6.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	4	6.8	
	Total		15	18.8	1.25

Table D66 : Measurements of metabolic rate at Female medical ward, Putrajaya.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Putrajaya - Female medical ward	Seated quiet	1.0	5	5.0	
	Typing	1.1	2	2.2	
	Standing relaxed	1.2	7	8.4	
	Filing (standing)	1.4	4	5.6	
	Walking about	1.7	2	3.4	
	Total		20	24.6	1.23

Table D67 : Measurements of metabolic rate at Pharmacy, Putrajaya.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Putrajaya - Pharmacy	Seated quiet	1.0	2	2.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	1	1.7	
	Total		5	6.5	1.30

Table D68 : Measurements of metabolic rate at X-ray & radiography, Putrajaya.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Putrajaya - X-ray & radiography	Seated quiet	1.0	1	1.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	3	4.2	
	Walking about	1.7	0	0.0	
	Total		5	6.4	1.28

Table D69 : Measurements of metabolic rate at Out-patient pharmacy, Putrajaya.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Putrajaya - Out-patient pharmacy	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	4	5.6	
	Walking about	1.7	0	0.0	
	Total		5	6.8	1.36

Table D70 : Measurements of metabolic rate at Day care unit, Putrajaya.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Putrajaya - Day care unit	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	4	5.6	
	Walking about	1.7	0	0.0	
	Total		4	5.6	1.40

Table D71 : Measurements of clothing value at Pediatric ward, Putrajaya.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Putrajaya - Pediatric ward	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	7	1.75	
	Normal trousers	0.15	10	1.50	
	Socks	0.02	10	0.20	
	Shoes	0.02	10	0.20	
	Jacket	0.36	0	0.00	
	Total		10	4.22	0.42

Table D72 : Measurements of clothing value at Orthopedic ward, Putrajaya.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Putrajaya - Orthopedic ward	Short-sleeve	0.19	7	1.33	
	Normal long-sleeve shirt	0.25	8	2.00	
	Normal trousers	0.15	15	2.25	
	Socks	0.02	15	0.30	
	Shoes	0.02	15	0.30	
	Jacket	0.36	1	0.36	
	Total		15	6.54	0.44

Table D73 : Measurements of clothing value at Female medical ward, Putrajaya.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Putrajaya - Female medical ward	Short-sleeve	0.19	10	1.90	
	Normal long-sleeve shirt	0.25	10	2.50	
	Normal trousers	0.15	20	3.00	
	Socks	0.02	20	0.40	
	Shoes	0.02	20	0.40	
	Jacket	0.36	1	0.36	
	Total		20	8.56	0.43

Table D74 : Measurements of clothing value at Pharmacy, Putrajaya.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Putrajaya - Pharmacy	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	5	1.25	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	5	0.10	
	Shoes	0.02	5	0.10	
	Jacket	0.36	1	0.36	
	Overall	0.49	1	0.49	
	Total		5	3.05	0.61

Table D75 : Measurements of clothing value at X-ray & radiography, Putrajaya.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Putrajaya - X-ray & radiography	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	4	1.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	5	0.10	
	Shoes	0.02	5	0.10	
	Jacket	0.36	1	0.36	
	Overall	0.49	3	1.47	
	Total		5	3.97	0.79

Table D76 : Measurements of clothing value at Out-patient pharmacy, Putrajaya.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Putrajaya - Out-patient pharmacy	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	5	1.25	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	5	0.10	
	Shoes	0.02	5	0.10	
	Jacket	0.36	0	0.00	
	Full slip	0.16	1	0.16	
	Skirt	0.14	1	0.14	
	Overall	0.49	2	0.98	
	Total		5	3.33	0.67

Table D77 : Measurements of clothing value at Day care unit, Putrajaya.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Putrajaya - Day care unit	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	4	1.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	4	0.08	
	Shoes	0.02	4	0.08	
	Jacket	0.36	2	0.72	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	0	0.00	
	Total		4	2.48	0.62

Table D78 : Measurements of AMV at Pediatric ward, Putrajaya.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Putrajaya - Pediatric ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	6	6.0	
	Neutral	0	4	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		10	6.0	0.60

Table D79 : Measurements of AMV at Orthopedic ward, Putrajaya.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Putrajaya - Orthopedic ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	6	0.0	
	Slightly cool	-1	5	-5.0	
	Cool	-2	3	-6.0	
	Cold	-3	0	0.0	
	Total		15	-10.0	-0.67

Table D80 : Measurements of AMV at Female medical ward, Putrajaya.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Putrajaya - Female medical ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	4	4.0	
	Neutral	0	9	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	2	-4.0	
	Cold	-3	1	-3.0	
	Total		20	-7.0	-0.35

Table D81 : Measurements of AMV at Pharmacy, Putrajaya.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Putrajaya - Pharmacy	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	0	0.0	
	Cold	-3	2	-6.0	
	Total		5	-8.0	-1.60

Table D82 : Measurements of AMV at X-ray & radiography, Putrajaya.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Putrajaya - X-ray & radiography	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	1	-2.0	
	Cold	-3	1	-3.0	
	Total		5	-6.0	-1.20

Table D83 : Measurements of AMV at Out-patient pharmacy, Putrajaya.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Putrajaya - Out-patient pharmacy	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		5	-4.0	-0.80

Table D84 : Measurements of AMV at Day care unit, Putrajaya.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Putrajaya - Day care unit	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table D85 : Measurements of air temperature at Outpatient pharmacy, Sungai Buloh.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Outpatient pharmacy	1	22.9	22.5	22.3	22.6	22.6
	2	21.5	21.3	21.3	21.2	21.3
	3	21.2	21.1	21.1	21.1	21.1
	4	20.9	20.8	20.8	20.7	20.8
	5	23.4	23.8	23.7	23.5	23.6
	6	19.7	19.8	19.9	20.0	19.9
	7	23.0	20.3	20.5	20.6	21.1
	Total average					21.5

Table D86 : Measurements of air temperature at Pathodology unit, Sungai Buloh.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pathodology unit	1	22.4	22.2	22.2	22.1	22.2
	2	24.2	24.3	24.7	25.5	24.7
	3	22.8	22.1	21.2	21.6	21.9
	4	21.4	21.2	21.3	21.4	21.3
	5	19.4	19.4	19.1	19.4	19.3
	6	20.2	20.3	20.4	20.6	20.4
	7	20.8	21.0	21.4	21.4	21.2
	Total average					21.6

Table D87 : Measurements of air temperature at X-Ray workstation, Sungai Buloh.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - X-Ray workstation	1	22.3	21.9	22.1	22.2	22.1
	2	21.8	21.6	21.3	21.5	21.6
	3	22.1	22.5	22.7	22.9	22.6
	4	22.8	22.6	22.4	22.1	22.5
	5	23.4	23.4	23.7	23.8	23.6
	6	23.9	23.1	23.6	23.7	23.6
	Total average					22.6

Table D88 : Measurements of air temperature at Pediatric ward, Sungai Buloh.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pediatric ward	1	22.2	22.1	22.3	22.4	22.3
	2	22.4	22.3	21.3	22.3	22.1
	3	21.9	22.2	22.4	22.4	22.2
	4	22.5	20.8	21.4	22.6	21.8
	5	22.3	22.4	22.4	39.6	26.7
	6	22.9	23.2	22.8	23.0	23.0
	Total average					23.0

Table D89 : Measurements of air temperature at Maternity ward, Sungai Buloh.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Maternity ward	1	23.3	23.2	22.6	22.7	23.0
	2	22.1	22.1	21.9	21.8	22.0
	3	21.1	21.2	21.4	21.0	21.2
	4	20.9	21.0	22.5	21.3	21.4
	5	21.6	21.7	21.8	22.0	21.8
	6	21.6	21.5	22.3	21.2	21.7
	Total average					21.8

Table D90 : Measurements of globe temperature at Outpatient pharmacy, Sungai Buloh.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Outpatient pharmacy	1	22.1	22.1	22.3	22.5	22.3
	2	21.5	21.5	21.6	21.7	21.6
	3	21.2	21.3	21.5	21.7	21.4
	4	21.0	21.0	21.2	21.3	21.1
	5	21.8	21.8	21.6	21.9	21.8
	6	19.8	20.0	20.1	20.6	20.1
	7	22.9	20.6	21.0	21.2	21.4
	Total average					21.4

Table D91 : Measurements of globe temperature at Pathodology unit, Sungai Buloh.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pathodology unit	1	22.1	22.3	22.3	22.5	22.3
	2	23.3	23.9	25.1	26.1	24.6
	3	22.8	22.2	21.6	22.1	22.2
	4	21.5	21.4	21.6	22.0	21.6
	5	19.7	19.9	19.8	20.2	19.9
	6	20.2	20.5	20.9	21.2	20.7
	7	20.9	21.3	21.9	22.0	21.5
	Total average					21.8

Table D92 : Measurements of globe temperature at X-Ray workstation, Sungai Buloh.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - X-Ray workstation	1	22.2	22.1	22.4	22.7	22.4
	2	21.8	21.8	21.6	22.0	21.8
	3	21.4	21.4	21.6	21.7	21.5
	4	21.0	21.6	21.8	22.0	21.6
	5	21.8	22.0	22.4	22.6	22.2
	6	21.4	21.8	21.9	22.5	21.9
	Total average					21.9

Table D93 : Measurements of globe temperature at Pediatric ward, Sungai Buloh.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pediatric ward	1	22.2	22.3	22.6	22.9	22.5
	2	22.4	22.5	21.6	22.8	22.3
	3	21.9	22.4	22.8	23.0	22.5
	4	22.5	20.9	21.7	23.2	22.1
	5	26.8	26.9	27.0	26.7	26.9
	6	22.8	23.3	23.3	23.5	23.2
	Total average					23.3

Table D94 : Measurements of globe temperature at Maternity ward, Sungai Buloh.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Maternity ward	1	23.5	23.6	21.3	23.6	23.0
	2	22.4	22.5	20.3	22.5	21.9
	3	21.3	21.5	19.7	21.8	21.1
	4	21.1	21.4	20.2	22.0	21.2
	5	21.7	22.1	20.5	22.9	21.8
	6	21.7	21.8	20.2	21.8	21.4
	Total average					21.7

Table D95 : Measurements of air velocity at Outpatient pharmacy, Sungai Buloh.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Outpatient pharmacy	1	0.03	0.13	0.08	0.09	0.08
	2	0.20	0.13	0.10	0.12	0.14
	3	0.04	0.08	0.16	0.15	0.11
	4	0.08	0.11	0.10	0.16	0.11
	5	0.14	0.17	0.18	0.16	0.16
	6	0.05	0.05	0.08	0.12	0.08
	7	0.20	0.15	0.17	0.13	0.16
	Total average					0.12

Table D96 : Measurements of air velocity at Pathodology unit, Sungai Buloh.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pathodology unit	1	0.05	0.13	0.08	0.09	0.09
	2	0.09	0.11	0.10	0.11	0.10
	3	0.15	0.16	0.16	0.15	0.16
	4	0.08	0.11	0.10	0.12	0.10
	5	0.14	0.16	0.19	0.16	0.16
	6	0.07	0.08	0.08	0.12	0.09
	7	0.20	0.15	0.17	0.14	0.17
	Total average					0.12

Table D97 : Measurements of air velocity at X-Ray workstation, Sungai Buloh.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - X-Ray workstation	1	0.05	0.13	0.08	0.09	0.09
	2	0.20	0.13	0.10	0.12	0.14
	3	0.04	0.08	0.15	0.14	0.10
	4	0.08	0.11	0.10	0.16	0.11
	5	0.14	0.15	0.16	0.16	0.15
	6	0.07	0.08	0.08	0.12	0.09
	Total average					0.11

Table D98 : Measurements of air velocity at Pediatric ward, Sungai Buloh.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pediatric ward	1	0.08	0.13	0.08	0.09	0.10
	2	0.11	0.11	0.10	0.12	0.11
	3	0.04	0.08	0.15	0.14	0.10
	4	0.08	0.11	0.10	0.16	0.11
	5	0.14	0.16	0.18	0.17	0.16
	6	0.08	0.09	0.10	0.12	0.10
	Total average					0.11

Table D99 : Measurements of air velocity at Maternity ward, Sungai Buloh.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Maternity ward	1	0.09	0.13	0.16	0.14	0.13
	2	0.06	0.06	0.09	0.13	0.09
	3	0.03	0.03	0.12	0.18	0.09
	4	0.06	0.10	0.11	0.10	0.09
	5	0.04	0.10	0.11	0.19	0.11
	6	0.07	0.05	0.08	0.10	0.08
	Total average					0.10

Table D100 : Measurements of relative humidity at Outpatient pharmacy, Sungai Buloh.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Outpatient pharmacy	1	64.4	68.6	69.5	70.1	68.2
	2	69.6	69.0	69.0	68.3	69.0
	3	68.0	67.4	67.7	67.7	67.7
	4	65.7	65.8	66.0	67.6	66.3
	5	66.2	65.1	68.8	68.9	67.3
	6	69.1	68.2	68.0	67.7	68.2
	7	70.3	67.2	60.3	66.7	66.1
	Total average					67.5

Table D101 : Measurements of relative humidity at Pathodology unit, Sungai Buloh.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pathodology unit	1	76.6	76.4	76.6	76.5	76.5
	2	59.7	59.6	56.9	54.3	57.6
	3	70.5	70.1	70.6	70.5	70.4
	4	72.2	72.8	72.4	72.1	72.4
	5	71.4	72.2	72.6	72.4	72.1
	6	73.2	73.1	72.8	72.2	72.8
	7	70.6	70.7	70.7	70.8	70.7
	Total average					70.4

Table D102 : Measurements of relative humidity at X-Ray workstation, Sungai Buloh.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - X-Ray workstation	1	67.6	68.1	68.0	68.1	68.0
	2	68.3	69.5	70.2	69.6	69.4
	3	69.4	70.4	70.7	70.6	70.3
	4	70.6	68.3	69.5	69.9	69.6
	5	67.0	67.6	67.1	67.1	67.2
	6	69.5	69.4	69.5	68.5	69.2
	Total average					68.9

Table D103 : Measurements of relative humidity at Pediatric ward, Sungai Buloh.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Pediatric ward	1	71.8	72.9	73.6	74.0	73.1
	2	72.9	73.0	69.0	72.7	71.9
	3	69.4	69.8	69.8	68.5	69.4
	4	68.2	65.8	67.3	67.3	67.1
	5	60.8	66.2	65.0	71.3	65.8
	6	62.6	62.4	62.7	63.0	62.7
	Total average					68.3

Table D104 : Measurements of relative humidity at Maternity ward, Sungai Buloh.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Sungai Buloh - Maternity ward	1	59.2	60.2	54.91	63.4	59.4
	2	64.2	64.0	58.95	67.0	63.5
	3	68.4	68.3	61.87	69.3	67.0
	4	69.2	68.9	61.77	68.8	67.2
	5	64.6	64.1	57.01	63.5	62.3
	6	65.4	65.6	59.46	67.0	64.4
	Total average					64.0

Table D105 : Measurements of metabolic rate at Outpatient pharmacy, Sungai Buloh.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Sungai Buloh - Outpatient pharmacy	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	6	7.2	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		11	12.6	1.15

Table D106 : Measurements of metabolic rate at Pathodology unit, Sungai Buloh.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Sungai Buloh - Pathodology unit	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	4	6.8	
	Total		4	6.8	1.70

Table D107 : Measurements of metabolic rate at X-Ray workstation, Sungai Buloh.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Sungai Buloh - X-Ray workstation	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	6	7.2	
	Filing (standing)	1.4	3	4.2	
	Walking about	1.7	4	6.8	
	Total		13	18.2	1.40

Table D108 : Measurements of metabolic rate at Pediatric ward, Sungai Buloh.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Sungai Buloh - Pediatric ward	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	1	1.7	
	Total		3	4.3	1.43

Table D109 : Measurements of metabolic rate at Maternity ward, Sungai Buloh.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Sungai Buloh - Maternity ward	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	3	5.1	
	Total		5	7.5	1.50

Table D110 : Measurements of clothing value at Outpatient pharmacy, Sungai Buloh.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Sungai Buloh - Outpatient pharmacy	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	7	1.75	
	Normal trousers	0.15	11	1.65	
	Socks	0.02	11	0.22	
	Shoes	0.02	11	0.22	
	Jacket	0.36	8	2.88	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	2	0.98	
	Total		11	8.46	0.77

Table D111 : Measurements of clothing value at Pathodology unit, Sungai Buloh.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Sungai Buloh - Pathodology unit	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	4	1.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	3	0.06	
	Shoes	0.02	4	0.08	
	Jacket	0.36	0	0.00	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	3	1.47	
	Total		4	3.21	0.80

Table D112 : Measurements of clothing value at X-Ray workstation, Sungai Buloh.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Sungai Buloh - X-Ray workstation	Short-sleeve	0.19	11	2.09	
	Normal long-sleeve shirt	0.25	13	3.25	
	Normal trousers	0.15	13	1.95	
	Socks	0.02	13	0.26	
	Shoes	0.02	13	0.26	
	Jacket	0.36	13	4.68	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	10	4.90	
	Total		13	17.39	1.34

Table D113 : Measurements of clothing value at Pediatric ward, Sungai Buloh.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Sungai Buloh - Pediatric ward	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	0	0.00	
	Shoes	0.02	3	0.06	
	Jacket	0.36	1	0.36	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	0	0.00	
	Total		3	1.44	0.48

Table D114 : Measurements of clothing value at Maternity ward, Sungai Buloh.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Sungai Buloh - Maternity ward	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	4	0.08	
	Shoes	0.02	5	0.10	
	Jacket	0.36	3	1.08	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	1	0.49	
	Total		5	3.51	0.70

Table D115 : Measurements of AMV at Outpatient pharmacy, Sungai Buloh.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Sungai Buloh - Outpatient pharmacy	Hot	3	0	0.0	
	Warm	2	2	4.0	
	Slightly warm	1	3	3.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	2	-4.0	
	Cold	-3	1	-3.0	
	Total		11	-1.0	-0.10

Table D116 : Measurements of AMV at Pathodology unit, Sungai Buloh.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Sungai Buloh - Pathodology unit	Hot	3	0	0.0	
	Warm	2	1	2.0	
	Slightly warm	1	0	0.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		4	1.0	0.10

Table D117 : Measurements of AMV at X-Ray workstation, Sungai Buloh.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Sungai Buloh - X-Ray workstation	Hot	3	0	0.0	
	Warm	2	1	2.0	
	Slightly warm	1	5	5.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	5	-5.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		13	2.0	0.10

Table D118 : Measurements of AMV at Pediatric ward, Sungai Buloh.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Sungai Buloh - Pediatric ward	Hot	3	0	0.0	
	Warm	2	1	2.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		3	1.0	0.30

Table D119 : Measurements of AMV at Maternity ward, Sungai Buloh.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Sungai Buloh - Maternity ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	2	2.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		5	-1.0	-0.20

Table D120 : Measurements of air temperature at Outpatient pharmacy, Selayang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Outpatient pharmacy	1	21.2	20.3	20.4	20.4	20.6
	2	19.6	19.7	19.6	19.4	19.6
	3	19.5	19.3	19.6	19.2	19.4
	4	19.0	18.8	18.3	18.6	18.7
	5	20.5	20.3	20.6	20.6	20.5
	6	20.9	21.0	21.2	21.1	21.0
	7	21.6	21.2	21.4	21.9	21.5
	Total average					20.2

Table D121 : Measurements of air temperature at Pediatric ward, Selayang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pediatric ward	1	25.4	25.0	24.9	24.7	25.0
	2	23.8	23.8	23.5	23.7	23.7
	3	22.6	23.1	23.0	23.0	22.9
	4	22.8	23.0	23.1	23.2	23.0
	5	23.0	23.0	22.7	22.7	22.9
	6	23.2	23.3	23.4	23.4	23.3
	Total average					23.5

Table D122 : Measurements of air temperature at Maternity ward, Selayang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Maternity ward	1	24.4	24.4	24.1	24.0	24.2
	2	25.7	26.1	26.3	26.5	26.1
	3	25.2	25.2	24.9	25.0	25.1
	4	25.2	25.3	25.3	25.3	25.3
	5	26.3	26.2	26.3	26.4	26.3
	6	25.0	25.3	25.2	25.1	25.1
	Total average					25.4

Table D123 : Measurements of air temperature at Pathodology unit, Selayang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pathodology unit	1	23.7	24.0	24.1	24.2	24.0
	2	23.4	23.5	23.5	23.6	23.5
	3	23.6	23.7	23.7	23.9	23.7
	4	22.8	22.6	22.4	22.6	22.6
	5	23.5	23.5	23.5	23.6	23.5
	6	22.0	22.3	22.2	22.0	22.1
	Total average					23.2

Table D124 : Measurements of air temperature at X-ray workstation, Selayang.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - X-ray workstation	1	21.7	22.1	22.0	22.0	21.9
	2	22.6	22.8	22.9	23.3	22.9
	3	22.4	22.2	22.5	22.2	22.3
	4	20.8	20.5	20.5	20.3	20.5
	5	20.5	20.6	20.6	20.7	20.6
	6	21.0	21.1	21.1	21.1	21.1
	7	21.0	21.0	20.7	20.9	20.9
	Total average					21.5

Table D125 : Measurements of globe temperature at Outpatient pharmacy, Selayang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Outpatient pharmacy	1	21.2	20.5	20.8	20.8	20.8
	2	19.6	19.9	19.7	19.9	19.8
	3	19.5	19.4	19.8	19.8	19.6
	4	19.1	19.1	18.7	19.1	19.0
	5	20.4	20.4	20.8	21.1	20.7
	6	20.7	20.7	21.1	21.4	21.0
	7	21.7	21.5	21.7	22.4	21.8
	Total average					20.4

Table D126 : Measurements of globe temperature at Pediatric ward, Selayang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pediatric ward	1	25.4	25.1	25.1	25.1	25.2
	2	23.7	23.9	23.8	24.2	23.9
	3	22.6	23.3	23.2	23.6	23.2
	4	22.8	23.2	23.4	23.6	23.3
	5	23.0	23.1	23.1	23.1	23.1
	6	23.3	23.5	23.7	23.9	23.6
	Total average					23.7

Table D127 : Measurements of globe temperature at Maternity ward, Selayang.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Maternity ward	1	24.4	24.6	24.3	24.3	24.4
	2	25.8	26.3	26.8	26.8	26.4
	3	25.2	25.4	25.3	25.4	25.3
	4	25.3	25.5	25.8	25.8	25.6
	5	26.3	26.4	26.6	26.8	26.5
	6	25.1	25.4	25.5	25.6	25.4
	Total average					25.6

Table D128 : Measurements of globe temperature at Pathodology unit, Selayang.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pathodology unit	1	23.7	24.1	24.4	24.6	24.2
	2	23.4	23.7	23.9	24.0	23.8
	3	23.6	23.8	24.0	24.4	24.0
	4	22.8	22.8	22.7	23.0	22.8
	5	23.4	23.6	24.0	24.2	23.8
	6	22.0	22.3	22.4	22.3	22.3
	Total average					23.5

Table D129 : Measurements of globe temperature at X-ray workstation, Selayang.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - X-ray workstation	1	21.8	22.3	22.4	22.4	22.2
	2	22.6	22.9	23.2	23.7	23.1
	3	22.4	22.4	22.8	22.7	22.6
	4	20.8	20.8	20.8	20.8	20.8
	5	20.5	20.7	20.9	21.2	20.8
	6	20.8	21.0	21.2	21.5	21.1
	7	21.1	21.3	20.9	21.4	21.2
	Total average					21.7

Table D130 : Measurements of air velocity at Outpatient pharmacy, Selayang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Outpatient pharmacy	1	0.17	0.21	0.12	0.05	0.14
	2	0.33	0.11	0.05	0.12	0.15
	3	0.12	0.07	0.06	0.13	0.10
	4	0.11	0.13	0.08	0.02	0.09
	5	0.10	0.09	0.09	0.12	0.10
	6	0.10	0.09	0.07	0.08	0.09
	7	0.11	0.08	0.06	0.07	0.08
	Total average					0.11

Table D131 : Measurements of air velocity at Pediatric ward, Selayang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pediatric ward	1	0.12	0.13	0.12	0.15	0.13
	2	0.12	0.17	0.14	0.12	0.14
	3	0.14	0.18	0.16	0.14	0.16
	4	0.10	0.10	0.08	0.09	0.09
	5	0.20	0.11	0.18	0.15	0.16
	6	0.10	0.11	0.09	0.10	0.10
	Total average					0.13

Table D132 : Measurements of air velocity at Maternity ward, Selayang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Maternity ward	1	0.21	0.18	0.15	0.11	0.16
	2	0.21	0.17	0.23	0.26	0.22
	3	0.17	0.16	0.13	0.15	0.15
	4	0.29	0.28	0.26	0.18	0.25
	5	0.19	0.14	0.17	0.18	0.17
	6	0.32	0.29	0.23	0.25	0.27
	Total average					0.20

Table D133 : Measurements of air velocity at Pathodology unit, Selayang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pathodology unit	1	0.13	0.09	0.11	0.12	0.11
	2	0.12	0.11	0.10	0.08	0.10
	3	0.17	0.10	0.09	0.13	0.12
	4	0.18	0.14	0.13	0.08	0.13
	5	0.10	0.09	0.24	0.22	0.16
	6	0.12	0.09	0.09	0.10	0.10
	Total average					0.12

Table D134 : Measurements of air velocity at X-ray workstation, Selayang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - X-ray workstation	1	0.18	0.14	0.17	0.11	0.15
	2	0.15	0.10	0.12	0.09	0.12
	3	0.10	0.08	0.07	0.08	0.08
	4	0.12	0.16	0.10	0.11	0.12
	5	0.15	0.13	0.10	0.12	0.13
	6	0.13	0.12	0.09	0.08	0.10
	7	0.14	0.16	0.10	0.13	0.13
	Total average					0.12

Table D135 : Measurements of relative humidity at Outpatient pharmacy, Selayang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Outpatient pharmacy	1	57.1	64.1	63.8	63.9	62.2
	2	64.3	64.1	65.3	66.8	65.1
	3	65.3	65.9	65.1	65.0	65.3
	4	65.7	66.9	67.9	67.8	67.1
	5	60.7	60.5	60.3	60.2	60.4
	6	61.0	60.1	60.6	59.6	60.3
	7	61.2	65.5	65.7	69.2	65.4
	Total average					63.7

Table D136 : Measurements of relative humidity at Pediatric ward, Selayang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pediatric ward	1	58.9	59.5	61.2	61.6	60.3
	2	58.5	58.5	58.9	63.7	59.9
	3	60.7	60.9	61.1	60.4	60.8
	4	60.2	60.3	60.2	60.4	60.3
	5	61.4	61.1	61.5	61.6	61.4
	6	63.5	64.0	63.9	63.8	63.8
	Total average					61.1

Table D137 : Measurements of relative humidity at Maternity ward, Selayang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Maternity ward	1	61.1	61.1	61.4	62.1	61.4
	2	58.4	57.9	56.1	55.3	56.9
	3	53.4	53.4	54.5	55.2	54.1
	4	55.0	54.6	54.2	54.2	54.5
	5	55.7	55.7	55.5	55.4	55.6
	6	55.5	55.3	55.6	55.5	55.5
	Total average					56.3

Table D138 : Measurements of relative humidity at Pathodology unit, Selayang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - Pathodology unit	1	62.3	62.4	61.8	61.8	62.1
	2	57.7	57.9	57.8	57.2	57.7
	3	62.5	62.6	62.7	62.8	62.7
	4	73.1	73.8	74.7	75.3	74.3
	5	55.1	55.1	54.9	55.6	55.2
	6	75.8	75.3	75.5	75.6	75.6
	Total average					64.6

Table D139 : Measurements of relative humidity at X-ray workstation, Selayang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Selayang - X-ray workstation	1	65.7	64.4	64.6	64.4	64.8
	2	62.1	61.3	61.5	60.9	61.4
	3	64.2	65.7	64.3	64.8	64.7
	4	72.1	72.1	73.2	74.1	72.9
	5	71.4	71.2	71.3	71.3	71.3
	5	69.2	68.9	69.0	68.9	69.0
	6	70.4	70.9	71.4	70.7	70.8
	Total average					67.8

Table D140 : Measurements of metabolic rate at Outpatient pharmacy, Selayang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Selayang - Outpatient pharmacy	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	5	7.0	
	Walking about	1.7	1	1.7	
	Total		7	9.9	1.40

Table D141 : Measurements of metabolic rate at Pediatric ward, Selayang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Selayang - Pediatric ward	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	1	1.7	
	Total		3	4.3	1.43

Table D142 : Measurements of metabolic rate at Maternity ward, Selayang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Selayang - Maternity ward	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	3	5.1	
	Total		5	7.5	1.50

Table D143 : Measurements of metabolic rate at Pathodology unit, Selayang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Selayang - Pathodology unit	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	4	4.8	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.8	1.20

Table D144 : Measurements of metabolic rate at X-ray workstation, Selayang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Selayang - X-ray workstation	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	5	6.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	6	1.20

Table D145 : Measurements of clothing value at Outpatient pharmacy, Selayang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Selayang - Outpatient pharmacy	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	7	1.75	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	7	0.14	
	Shoes	0.02	7	0.14	
	Jacket	0.36	7	2.52	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	7	3.43	
	Total		7	9.60	1.37

Table D146 : Measurements of clothing value at Pediatric ward, Selayang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Selayang - Pediatric ward	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	0	0.00	
	Shoes	0.02	3	0.06	
	Jacket	0.36	1	0.36	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	0	0.00	
	Total		3	1.44	0.48

Table D147 : Measurements of clothing value at Maternity ward, Selayang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Selayang - Maternity ward	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	1	0.02	
	Shoes	0.02	5	0.10	
	Jacket	0.36	3	1.08	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	1	0.49	
	Total		5	3.51	0.70

Table D148 : Measurements of clothing value at Pathodology unit, Selayang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Selayang - Pathodology unit	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	3	0.75	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	4	0.08	
	Shoes	0.02	4	0.08	
	Jacket	0.36	2	0.72	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	2	0.98	
	Total		4	3.40	0.85

Table D149 : Measurements of clothing value at X-ray workstation, Selayang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Selayang - X-ray workstation	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	5	0.10	
	Shoes	0.02	5	0.10	
	Jacket	0.36	4	1.44	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	5	2.45	
	Total		5	5.85	1.17

Table D150 : Measurements of AMV at Outpatient pharmacy, Selayang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Selayang - Outpatient pharmacy	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	5	-5.0	
	Cool	-2	0	0.0	
	Cold	-3	2	-6.0	
	Total		7	-11.0	-2.40

Table D151 : Measurements of AMV at Pediatric ward, Selayang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Selayang - Pediatric ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		3	-2.0	-0.80

Table D152 : Measurements of AMV at Maternity ward, Selayang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Selayang - Maternity ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		5	-2.0	-0.40

Table D153 : Measurements of AMV at Pathodology unit, Selayang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Selayang - Pathodology unit	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		4	-5.0	-1.20

Table D154 : Measurements of AMV at X-ray workstation, Selayang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Selayang - X-ray workstation	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		5	-7.0	-1.70

Table D155 : Measurements of air temperature at PAC, Klang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Picture Archiving Communication	1	24.3	24.7	24.5	24.6	24.5
	2	24.4	24.6	24.7	25.1	24.7
	3	23.8	23.6	23.9	23.6	23.7
	4	24.7	24.3	24.3	24.1	24.3
	5	24.4	24.4	24.5	24.6	24.5
	6	24.6	24.7	24.7	24.6	24.7
	7	24.3	24.2	23.9	24.1	24.1
	Total average					24.4

Table D156 : Measurements of air temperature at Pathology, Klang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Pathology	1	23.3	23.5	23.6	23.7	23.5
	2	23.0	23.1	23.1	23.2	23.1
	3	22.9	23.0	23.0	23.2	23.0
	4	23.0	22.8	22.6	22.8	22.8
	5	23.4	23.4	23.4	23.4	23.4
	6	22.8	23.1	23.0	22.8	22.9
	7	22.6	22.9	23.0	23.1	22.9
	Total average					23.1

Table D157 : Measurements of air temperature at X-ray & radiography, Klang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - X-ray & radiography	1	25.1	25.5	25.4	25.4	25.3
	2	24.4	24.6	24.7	25.1	24.7
	3	25.4	25.2	25.5	25.1	25.3
	4	26.7	26.3	26.3	26.0	26.3
	5	25.3	25.4	25.4	25.6	25.4
	6	25.2	25.3	25.3	25.3	25.3
	7	25.2	25.1	24.9	25.0	25.1
	8	24.4	24.7	24.6	24.6	24.6
	Total average					25.2

Table D158 : Measurements of air temperature at Cytology laboratory, Klang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Cytology laboratory	1	19.7	19.8	19.9	19.9	19.8
	2	20.8	20.9	20.9	21.0	20.9
	3	20.6	20.7	20.7	20.8	20.7
	4	21.4	21.2	21.0	21.2	21.2
	5	20.9	20.9	20.9	21.0	20.9
	6	21.1	21.4	21.3	21.1	21.2
	7	21.0	21.2	21.3	21.4	21.2
	8	20.8	20.9	20.9	21.0	20.9
	Total average					20.9

Table D159 : Measurements of air temperature at Endoscopy, Klang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Endoscopy	1	20.4	20.1	20.2	19.9	20.2
	2	19.9	19.9	19.8	19.7	19.8
	3	20.2	20.3	20.3	20.4	20.3
	4	20.4	20.5	20.5	20.5	20.5
	5	20.2	20.2	20.3	20.4	20.3
	6	20.2	20.1	20.1	20.1	20.1
	7	22.2	22.3	22.4	22.5	22.4
	8	22.2	22.2	22.2	22.3	22.2
	Total average					20.7

Table D160 : Measurements of air temperature at Medical day care, Klang.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Medical day care	1	19.8	19.7	19.7	19.7	19.7
	2	23.2	23.1	23.2	23.2	23.2
	3	21.2	21.4	21.5	21.7	21.5
	4	22.0	22.0	22.1	22.1	22.1
	5	22.5	22.5	22.6	22.7	22.6
	6	23.0	22.9	23.0	23.0	23.0
	7	23.1	23.1	23.2	23.2	23.2
	8	23.3	23.3	23.4	23.4	23.4
	9	23.3	23.3	23.3	23.4	23.3
	10	19.6	19.8	19.8	20.1	19.8
	Total average					22.2

Table D161 : Measurements of globe temperature at PAC, Klang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Picture Archiving Communication	1	23.9	24.4	24.5	24.5	24.3
	2	23.9	24.2	24.5	25.0	24.4
	3	22.8	22.8	23.3	23.2	23.0
	4	24.6	24.6	24.5	24.5	24.5
	5	24.7	25.0	25.2	25.6	25.1
	6	24.6	24.8	25.1	25.2	24.9
	7	24.4	24.7	24.2	24.8	24.5
	Total average					24.4

Table D162 : Measurements of globe temperature at Pathology, Klang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Pathology	1	23.1	23.5	23.8	24.0	23.6
	2	22.5	22.8	22.9	23.0	22.8
	3	22.4	22.6	22.8	23.2	22.8
	4	22.7	22.7	22.6	22.9	22.7
	5	23.3	23.5	23.9	24.1	23.7
	6	22.6	22.9	23.0	22.9	22.9
	7	22.7	22.9	23.1	23.5	23.1
	Total average					23.1

Table D163 : Measurements of globe temperature at X-ray & radiography, Klang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - X-ray & radiography	1	25.0	25.6	25.7	25.7	25.5
	2	24.3	24.6	24.9	25.4	24.8
	3	25.6	25.6	26.1	26.0	25.8
	4	26.1	26.1	26.0	26.0	26.0
	5	24.6	24.9	25.1	25.5	25.0
	6	25.1	25.3	25.6	25.7	25.4
	7	25.1	25.4	24.9	25.5	25.2
	8	23.6	24.1	24.2	24.2	24.0
	Total average					25.2

Table D164 : Measurements of globe temperature at Cytology laboratory, Klang.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Cytology laboratory	1	19.3	19.7	19.7	19.7	19.6
	2	20.6	20.9	21.2	21.6	21.1
	3	21.0	21.0	21.3	21.2	21.1
	4	21.0	21.0	20.9	20.9	20.9
	5	20.2	20.4	20.6	20.9	20.5
	6	20.8	21.0	21.3	21.4	21.1
	7	21.5	21.8	21.3	21.9	21.6
	8	20.9	21.4	21.5	21.5	21.3
	Total average					20.9

Table D165 : Measurements of globe temperature at Endoscopy, Klang.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Endoscopy	1	19.7	20.2	20.3	20.3	20.1
	2	19.4	19.6	19.9	20.3	19.8
	3	20.1	20.1	20.4	20.3	20.2
	4	20.5	20.5	20.5	20.5	20.5
	5	20.2	20.4	20.6	20.9	20.5
	6	20.1	20.3	20.4	20.5	20.3
	7	21.6	21.9	21.4	22.0	21.7
	8	22.0	22.5	22.6	22.6	22.4
	Total average					20.7

Table D166 : Measurements of globe temperature at Medical day care, Klang.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Medical day care	1	19.2	19.5	19.8	19.9	19.6
	2	23.0	23.3	23.4	23.5	23.3
	3	20.9	21.1	21.3	21.7	21.3
	4	22.2	22.2	22.1	22.4	22.2
	5	22.1	22.3	22.7	22.9	22.5
	6	22.5	22.7	22.7	22.7	22.7
	7	23.1	23.3	23.5	23.9	23.5
	8	23.7	23.7	23.6	23.9	23.7
	9	23.3	23.5	23.9	24.1	23.7
	10	19.4	19.7	19.8	19.7	19.7
	Total average					22.2

Table D167 : Measurements of air velocity at PAC, Klang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Picture Archiving Communication	1	0.14	0.35	0.21	0.24	0.24
	2	0.21	0.24	0.23	0.25	0.23
	3	0.19	0.20	0.20	0.20	0.20
	4	0.15	0.21	0.19	0.23	0.19
	5	0.22	0.25	0.30	0.25	0.25
	6	0.22	0.23	0.23	0.35	0.26
	7	0.25	0.19	0.21	0.18	0.21
	Total average					0.23

Table D168 : Measurements of air velocity at Pathology, Klang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Pathology	1	0.20	0.40	0.25	0.28	0.28
	2	0.28	0.33	0.31	0.33	0.31
	3	0.26	0.27	0.27	0.26	0.27
	4	0.22	0.31	0.28	0.32	0.28
	5	0.24	0.27	0.32	0.27	0.27
	6	0.24	0.26	0.26	0.39	0.29
	7	0.27	0.20	0.23	0.20	0.23
	Total average					0.28

Table D169 : Measurements of air velocity at X-ray & radiography, Klang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - X-ray & radiography	1	0.18	0.14	0.17	0.12	0.15
	2	0.18	0.12	0.14	0.11	0.14
	3	0.20	0.17	0.15	0.17	0.17
	4	0.15	0.18	0.12	0.13	0.14
	5	0.22	0.19	0.16	0.18	0.19
	6	0.14	0.14	0.11	0.10	0.12
	7	0.17	0.20	0.12	0.16	0.16
	8	0.19	0.16	0.14	0.16	0.16
	Total average					0.16

Table D170 : Measurements of air velocity at Cytology laboratory, Klang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Cytology laboratory	1	0.48	0.37	0.45	0.29	0.40
	2	0.61	0.42	0.49	0.42	0.49
	3	0.53	0.46	0.40	0.46	0.46
	4	0.55	0.68	0.45	0.50	0.54
	5	0.57	0.49	0.44	0.45	0.49
	6	0.56	0.56	0.43	0.38	0.48
	7	0.58	0.64	0.42	0.54	0.54
	8	0.60	0.53	0.46	0.53	0.53
	Total average					0.49

Table D171 : Measurements of air velocity at Endoscopy, Klang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Endoscopy	1	0.09	0.08	0.07	0.05	0.07
	2	0.04	0.03	0.04	0.05	0.04
	3	0.05	0.04	0.03	0.04	0.04
	4	0.05	0.04	0.04	0.03	0.04
	5	0.07	0.05	0.06	0.06	0.06
	6	0.04	0.04	0.03	0.03	0.04
	7	0.07	0.05	0.06	0.06	0.06
	8	0.04	0.04	0.03	0.03	0.04
	Total average					0.05

Table D172 : Measurements of air velocity at Medical day care, Klang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Medical day care	1	0.05	0.05	0.04	0.03	0.04
	2	0.04	0.03	0.04	0.05	0.04
	3	0.10	0.10	0.08	0.09	0.09
	4	0.06	0.06	0.05	0.04	0.05
	5	0.06	0.04	0.05	0.05	0.05
	6	0.07	0.06	0.05	0.06	0.06
	7	0.10	0.07	0.09	0.10	0.09
	8	0.05	0.04	0.03	0.04	0.04
	9	0.05	0.04	0.03	0.04	0.04
	10	0.09	0.09	0.08	0.06	0.08
	Total average					0.06

Table D173 : Measurements of relative humidity at PAC, Klang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Picture Archiving Communication	1	49.6	49.7	49.2	49.2	49.4
	2	50.2	50.3	50.2	49.7	50.1
	3	49.5	49.6	49.6	49.7	49.6
	4	49.0	49.5	50.1	50.5	49.8
	5	51.1	51.1	50.9	51.6	51.2
	6	53.6	53.2	53.4	53.4	53.4
	7	50.9	50.9	50.7	51.4	51.0
	Total average					50.6

Table D174 : Measurements of relative humidity at Pathology, Klang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Pathology	1	42.8	42.9	42.5	42.5	42.7
	2	45.3	45.4	45.3	44.8	45.2
	3	47.3	47.4	47.4	47.5	47.4
	4	47.1	47.5	48.1	48.5	47.8
	5	47.8	47.8	47.7	48.3	47.9
	6	47.2	47.0	47.1	47.1	47.1
	7	46.2	46.2	46.1	46.7	46.3
	Total average					46.3

Table D175 : Measurements of relative humidity at X-ray & radiography, Klang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - X-ray & radiography	1	70.3	69.4	69.6	69.0	69.6
	2	70.1	71.7	70.2	70.8	70.7
	3	71.4	71.4	72.4	73.3	72.1
	4	74.1	73.9	74.0	74.0	74.0
	5	64.2	64.0	64.0	64.0	64.0
	6	71.9	72.3	72.9	72.1	72.3
	7	69.2	69.0	69.2	69.0	69.1
	8	69.9	70.3	70.8	70.1	70.3
	Total average					70.3

Table D176 : Measurements of relative humidity at Cytology laboratory, Klang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Cytology laboratory	1	49.3	49.4	48.9	48.9	49.1
	2	48.2	48.3	48.2	47.7	48.1
	3	48.4	48.5	48.5	48.6	48.5
	4	45.9	46.3	46.9	47.3	46.6
	5	47.8	47.8	47.7	48.3	47.9
	6	47.1	46.9	47.0	47.0	47.0
	7	47.6	47.6	47.5	48.1	47.7
	8	47.8	47.5	47.6	47.7	47.7
	Total average					47.8

Table D177 : Measurements of relative humidity at Endoscopy, Klang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Endoscopy	1	75.1	75.3	75.0	75.5	75.2
	2	76.2	76.6	76.5	76.8	76.5
	3	75.0	74.7	74.7	74.2	74.7
	4	74.9	74.5	74.6	74.5	74.6
	5	74.8	74.6	74.7	74.8	74.7
	6	76.0	76.0	76.1	76.1	76.1
	7	73.3	73.2	72.9	72.3	72.9
	8	72.8	72.8	73.3	73.0	73.0
	Total average					74.7

Table D178 : Measurements of relative humidity at Medical day care, Klang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Klang - Medical day care	1	76.9	77.4	77.7	77.6	77.4
	2	68.5	68.6	68.7	68.7	68.6
	3	74.0	73.8	73.6	73.0	73.6
	4	72.0	72.0	71.8	71.8	71.9
	5	71.0	70.9	70.7	70.3	70.7
	6	69.5	69.5	69.5	69.5	69.5
	7	68.7	68.7	68.7	68.7	68.7
	8	68.0	68.2	68.3	68.1	68.2
	9	68.0	67.9	67.9	67.8	67.9
	10	76.7	76.5	76.3	76.2	76.4
	Total average					71.3

Table D179 : Measurements of metabolic rate at PAC, Klang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Klang - Picture Archiving Communication	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	3	4.2	
	Walking about	1.7	0	0.0	
	Total		3	4.2	1.40

Table D180 : Measurements of metabolic rate at Pathology, Klang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Klang - Pathology	Seated quiet	1.0	0	0	
	Typing	1.1	0	0	
	Standing relaxed	1.2	0	0	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	0	0	
	Total		2	2.8	1.40

Table D181 : Measurements of metabolic rate at X-ray & radiography, Klang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Klang - X-ray & radiography	Seated quiet	1.0	0	0	
	Typing	1.1	0	0	
	Standing relaxed	1.2	0	0	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	1	1.7	
	Total		3	4.5	1.50

Table D182 : Measurements of metabolic rate at Cytology laboratory, Klang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Klang - Cytology laboratory	Seated quiet	1.0	0	0	
	Typing	1.1	0	0	
	Standing relaxed	1.2	0	0	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	1	1.7	
	Total		3	4.5	1.50

Table D183 : Measurements of metabolic rate at Endoscopy, Klang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Klang - Endoscopy	Seated quiet	1.0	0	0	
	Typing	1.1	0	0	
	Standing relaxed	1.2	0	0	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	4	6.8	
	Total		6	9.6	1.60

Table D184 : Measurements of metabolic rate at Medical day care, Klang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Klang - Medical day care	Seated quiet	1.0	0	0	
	Typing	1.1	0	0	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	7	9.8	
	Walking about	1.7	0	0	
	Total		9	12.2	1.36

Table D185 : Measurements of clothing value at PAC, Klang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Klang - Picture Archiving Communication	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	3	0.06	
	Shoes	0.02	3	0.06	
	Jacket	0.36	0	0.00	
	Total		3	1.14	0.38

Table D186 : Measurements of clothing value at Pathology, Klang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Klang - Pathology	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	2	0.30	
	Socks	0.02	2	0.04	
	Shoes	0.02	2	0.04	
	Jacket	0.36	1	0.36	
	Total		2	1.24	0.62

Table D187 : Measurements of clothing value at X-ray & radiography, Klang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Klang - X-ray & radiography	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	3	0.06	
	Shoes	0.02	3	0.06	
	Jacket	0.36	1	0.36	
	Total		3	1.62	0.54

Table D188 : Measurements of clothing value at Cytology laboratory, Klang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Klang - Cytology laboratory	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	3	0.06	
	Shoes	0.02	3	0.06	
	Jacket	0.36	0	0.00	
	Overall	0.49	2	0.98	
	Total		3	2.24	0.75

Table D189 : Measurements of clothing value at Endoscopy, Klang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Klang - Endoscopy	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	6	1.50	
	Normal trousers	0.15	6	0.90	
	Socks	0.02	0	0.00	
	Shoes	0.02	6	0.12	
	Jacket	0.36	0	0.00	
	Overall	0.49	0	0.00	
	Total		6	2.52	0.42

Table D190 : Measurements of clothing value at Medical day care, Klang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Klang - Medical day care	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	8	2.00	
	Normal trousers	0.15	9	1.35	
	Socks	0.02	7	0.14	
	Shoes	0.02	9	0.18	
	Jacket	0.36	2	0.72	
	Full slip	0.16	0	0.00	
	Skirt	0.14	0	0.00	
	Overall	0.49	0	0.00	
	Total		9	4.58	0.51

Table D191 : Measurements of AMV at PAC, Klang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Klang - Picture Archiving Communication	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	3	3.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		3	3.0	1.00

Table D192 : Measurements of AMV at Pathology, Klang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Klang - Pathology	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		2	-2.0	-1.00

Table D193 : Measurements of AMV at X-ray & radiography, Klang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Klang - X-ray & radiography	Hot	3	0	0.0	
	Warm	2	1	2.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		3	1.0	0.33

Table D194 : Measurements of AMV at Cytology laboratory, Klang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Klang - Cytology laboratory	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	2	-6.0	
	Total		3	-5.0	-1.67

Table D195 : Measurements of AMV at Endoscopy, Klang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Klang - Endoscopy	Hot	3	0	0.0	
	Warm	2	4.5	9.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1.5	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		6	9.0	1.50

Table D196 : Measurements of AMV at Medical day care, Klang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Klang - Medical day care	Hot	3	0	0.0	
	Warm	2	3	6.0	
	Slightly warm	1	1	1.0	
	Neutral	0	5	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		9	7.0	0.77

Table D197 : Measurements of air temperature at Clinic, Kajang.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Clinic	1	25.8	25.3	25.1	25.4	25.4
	2	25.8	25.5	25.5	25.4	25.5
	3	25.4	25.3	25.3	25.3	25.3
	4	25.4	25.3	25.3	25.2	25.3
	5	25.2	25.6	25.5	25.3	25.4
	6	25.3	25.4	25.6	25.7	25.5
	Total average					25.4

Table D198 : Measurements of air temperature at Haemodialisis, Kajang.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Haemodialisis	1	25.9	25.4	25.7	25.8	25.7
	2	25.8	25.5	25.2	25.4	25.5
	3	25.2	25.6	25.9	26.1	25.7
	4	26.2	25.9	25.7	25.4	25.8
	5	25.7	25.7	26.0	26.1	25.9
	6	26.4	25.5	26.0	26.1	26.0
	Total average					25.8

Table D199 : Measurements of air temperature at Pharmacy, Kajang.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Pharmacy	1	25.5	25.1	24.9	25.2	25.2
	2	25.5	25.3	25.3	25.2	25.3
	3	25.3	25.1	25.1	25.1	25.2
	4	25.3	25.2	25.2	25.1	25.2
	5	24.9	25.3	25.2	25.0	25.1
	6	25.0	25.1	25.2	25.4	25.2
	Total average					25.2

Table D200 : Measurements of air temperature at X-ray & radiography, Kajang.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - X-ray & radiography	1	23.4	23.0	23.2	23.3	23.2
	2	23.1	22.9	22.6	22.8	22.9
	3	22.8	23.2	23.5	23.7	23.3
	4	24.0	23.8	23.5	23.2	23.6
	5	23.5	23.5	23.8	23.9	23.7
	6	23.8	23.0	23.5	23.6	23.5
	Total average					23.4

Table D201 : Measurements of globe temperature at Clinic, Kajang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Clinic	1	25.8	24.9	25.3	25.3	25.3
	2	25.3	25.7	25.4	25.7	25.5
	3	25.1	25.0	25.5	25.5	25.2
	4	25.6	25.6	25.1	25.4	25.4
	5	25.1	25.1	25.6	26.0	25.5
	6	25.1	25.1	25.6	25.9	25.4
	Total average					25.4

Table D202 : Measurements of globe temperature at Haemodialisis, Kajang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Haemodialisis	1	25.1	25.7	25.8	25.8	25.6
	2	24.8	25.1	25.4	26.0	25.3
	3	25.4	25.4	25.9	25.8	25.6
	4	25.9	25.9	25.8	25.8	25.8
	5	25.7	26.0	26.2	26.6	26.1
	6	25.9	26.1	26.4	26.4	26.2
	Total average					25.8

Table D203 : Measurements of globe temperature at Pharmacy, Kajang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Pharmacy	1	25.1	24.2	24.6	24.6	24.6
	2	24.7	25.1	24.9	25.1	25.0
	3	25.8	25.6	26.2	26.2	25.9
	4	25.3	25.3	24.8	25.2	25.1
	5	24.7	24.7	25.2	25.6	25.1
	6	25.0	25.0	25.5	25.8	25.3
	Total average					25.2

Table D204 : Measurements of globe temperature at X-ray & radiography, Kajang.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - X-ray & radiography	1	22.0	22.6	22.7	22.7	22.5
	2	22.4	22.7	23.0	23.5	22.9
	3	23.4	23.4	23.8	23.7	23.6
	4	24.0	24.0	23.9	23.9	23.9
	5	23.6	23.8	24.0	24.2	23.9
	6	23.4	23.6	23.9	24.0	23.7
	Total average					23.4

Table D205 : Measurements of air velocity at Clinic, Kajang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Clinic	1	0.06	0.26	0.17	0.19	0.17
	2	0.21	0.14	0.11	0.13	0.15
	3	0.05	0.11	0.22	0.20	0.15
	4	0.13	0.18	0.16	0.26	0.18
	5	0.14	0.17	0.18	0.16	0.16
	6	0.14	0.14	0.19	0.29	0.19
	Total average					0.17

Table D206 : Measurements of air velocity at Haemodialisis, Kajang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Haemodialisis	1	0.09	0.23	0.14	0.16	0.16
	2	0.21	0.14	0.11	0.13	0.15
	3	0.08	0.15	0.29	0.27	0.19
	4	0.12	0.16	0.15	0.23	0.16
	5	0.16	0.17	0.18	0.18	0.17
	6	0.12	0.13	0.13	0.20	0.15
	Total average					0.16

Table D207 : Measurements of air velocity at Pharmacy, Kajang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Pharmacy	1	0.06	0.24	0.15	0.17	0.15
	2	0.23	0.15	0.11	0.14	0.16
	3	0.07	0.13	0.26	0.25	0.18
	4	0.12	0.17	0.15	0.25	0.17
	5	0.16	0.19	0.20	0.18	0.18
	6	0.14	0.14	0.20	0.30	0.20
	Total average					0.17

Table D208 : Measurements of air velocity at X-ray & radiography, Kajang.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - X-ray & radiography	1	0.15	0.33	0.20	0.23	0.23
	2	0.30	0.20	0.15	0.18	0.21
	3	0.10	0.19	0.34	0.34	0.24
	4	0.16	0.23	0.20	0.33	0.23
	5	0.19	0.20	0.21	0.21	0.20
	6	0.13	0.15	0.15	0.23	0.17
	Total average					0.21

Table D209 : Measurements of relative humidity at Clinic, Kajang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Clinic	1	49.2	55.2	55.0	55.1	53.6
	2	51.7	51.5	52.4	53.7	52.3
	3	50.9	51.3	50.7	50.6	50.9
	4	50.8	51.8	52.5	52.5	51.9
	5	53.8	53.5	53.4	53.3	53.5
	6	53.0	52.2	52.6	51.8	52.4
	Total average					52.4

Table D210 : Measurements of relative humidity at Haemodialisis, Kajang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Haemodialisis	1	58.8	58.1	58.2	57.7	58.2
	2	58.5	59.8	58.5	59.0	58.9
	3	58.8	58.8	59.6	60.4	59.4
	4	60.4	60.3	60.3	60.3	60.3
	5	59.7	59.4	59.5	59.4	59.5
	6	58.6	59.0	59.4	58.8	58.9
	Total average					59.2

Table D211 : Measurements of relative humidity at Pharmacy, Kajang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - Pharmacy	1	52.9	59.4	59.2	59.2	57.7
	2	56.3	56.1	57.1	58.5	57.0
	3	57.6	58.1	57.4	57.3	57.6
	4	57.1	58.1	58.9	58.9	58.3
	5	57.6	57.3	57.2	57.1	57.3
	6	59.7	58.8	59.2	58.3	59.0
	Total average					57.8

Table D212 : Measurements of relative humidity at X-ray & radiography, Kajang.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kajang - X-ray & radiography	1	50.3	49.7	49.8	49.4	49.8
	2	50.8	51.9	50.8	51.2	51.2
	3	52.4	52.4	53.1	53.8	52.9
	4	53.5	53.4	53.4	53.5	53.5
	5	54.4	54.2	54.2	54.2	54.2
	6	57.2	57.5	57.9	57.4	57.5
	Total average					53.2

Table D213 : Measurements of metabolic rate at Clinic, Kajang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Kajang - Clinic	Seated quiet	1.0	2	2.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		3	3.4	1.13

Table D214 : Measurements of metabolic rate at Haemodialisis, Kajang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Kajang - Haemodialisis	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	3	4.2	
	Walking about	1.7	0	0.0	
	Total		3	4.2	1.40

Table D215 : Measurements of metabolic rate at Pharmacy, Kajang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Kajang - Pharmacy	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	1	1.7	
	Total		2	3.1	1.55

Table D216 : Measurements of metabolic rate at X-ray & radiography, Kajang.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Kajang - X-ray & radiography	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	4	5.6	
	Walking about	1.7	0	0.0	
	Total		4	5.6	1.40

Table D217 : Measurements of clothing value at Clinic, Kajang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Kajang - Clinic	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	3	0.75	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	3	0.06	
	Shoes	0.02	3	0.06	
	Jacket	0.36	0	0.00	
	Overall	0.49	0	0.00	
	Total		3	1.32	0.44

Table D218 : Measurements of clothing value at Haemodialisis, Kajang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Kajang - Haemodialisis	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	3	0.75	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	3	0.06	
	Shoes	0.02	3	0.06	
	Jacket	0.36	0	0.00	
	Overall	0.49	1	0.49	
	Total		3	1.81	0.60

Table D219 : Measurements of clothing value at Pharmacy, Kajang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Kajang - Pharmacy	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	2	0.30	
	Socks	0.02	2	0.04	
	Shoes	0.02	2	0.04	
	Jacket	0.36	0	0.00	
	Overall	0.49	0	0.00	
	Total		2	0.88	0.44

Table D220 : Measurements of clothing value at X-ray & radiography, Kajang.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Kajang - X-ray & radiography	Short-sleeve	0.19	2	0.38	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	4	0.08	
	Shoes	0.02	4	0.08	
	Jacket	0.36	0	0.00	
	Overall	0.49	2	0.98	
	Total		4	2.62	0.66

Table D221 : Measurements of AMV at Clinic, Kajang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Kajang - Clinic	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		3	-4.0	-1.33

Table D222 : Measurements of AMV at Haemodialisis, Kajang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Kajang - Haemodialisis	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	3	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		3	0.0	0.00

Table D223 : Measurements of AMV at Pharmacy, Kajang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Kajang - Pharmacy	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	2	2.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		2	2.0	1.00

Table D224 : Measurements of AMV at X-ray & radiography, Kajang.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Kajang - X-ray & radiography	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		4	-5.0	-1.25

Table D225 : Measurements of air temperature at A & E ward, Private hospital.

Hospital - Department	Sampling Point	T_{air} (^{o}C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Accident & Emergency ward	1	20.7	20.5	20.5	20.4	20.5
	2	21.2	21.3	21.6	22.2	21.6
	3	22.1	21.6	20.7	21.1	21.4
	4	24.0	23.8	23.9	23.9	23.9
	5	20.4	20.4	20.1	20.4	20.3
	6	22.6	22.7	22.8	23.0	22.8
	7	21.5	21.6	22.0	22.0	21.8
	Total average					21.7

Table D226 : Measurements of air temperature at Labor ward, Private hospital.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Labor ward	1	24.8	24.7	24.0	24.1	24.4
	2	21.1	21.1	20.9	20.8	20.9
	3	21.1	21.2	21.4	21.0	21.1
	4	20.0	20.1	21.5	20.4	20.5
	5	23.2	23.3	23.5	23.7	23.4
	6	22.9	22.8	23.7	22.5	23.0
	7	23.5	23.4	22.8	22.9	23.2
	Total average					22.4

Table D227 : Measurements of air temperature at Delivery Suite, Private hospital.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Delivery Suite	1	20.7	20.6	20.1	20.2	20.4
	2	22.4	22.4	22.2	22.1	22.3
	3	21.2	21.3	21.5	21.1	21.3
	4	22.3	22.4	24.0	22.7	22.9
	5	21.6	21.7	21.9	22.1	21.8
	6	21.8	21.7	22.5	21.4	21.9
	7	22.6	22.5	22.0	22.0	22.3
	Total average					21.8

Table D228 : Measurements of air temperature at Intensive Care Unit, Private hospital.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Intensive Care Unit	1	22.7	22.5	22.5	22.4	22.5
	2	22.5	22.6	22.9	23.6	22.9
	3	23.2	22.5	21.5	21.9	22.3
	4	23.8	23.6	23.7	23.8	23.7
	5	21.7	21.7	21.4	21.7	21.6
	6	22.7	22.8	22.9	23.1	22.9
	7	22.8	22.9	23.3	23.3	23.1
	Total average					22.7

Table D229 : Measurements of globe temperature at A & E ward, Private hospital.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Accident & Emergency ward	1	20.0	20.5	20.5	20.5	20.4
	2	21.3	21.6	21.9	22.4	21.8
	3	21.5	21.5	21.8	21.7	21.6
	4	24.3	24.2	24.2	24.2	24.2
	5	18.7	18.9	19.1	19.4	19.0
	6	22.8	23.0	23.2	23.4	23.1
	7	22.0	22.2	21.8	22.2	22.1
	Total average					21.7

Table D230 : Measurements of globe temperature at Labor ward, Private hospital.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Labor ward	1	24.4	24.6	24.3	24.3	24.4
	2	20.4	20.8	21.2	21.2	20.9
	3	21.1	21.2	21.1	21.1	21.1
	4	20.3	20.5	20.7	20.7	20.5
	5	23.3	23.4	23.6	23.8	23.5
	6	22.9	23.1	23.2	23.3	23.1
	7	23.1	23.3	23.5	23.5	23.3
	Total average					22.4

Table D231 : Measurements of globe temperature at Delivery Suite, Private hospital.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Delivery Suite	1	20.8	21.0	20.7	20.7	20.8
	2	22.1	22.5	22.9	22.9	22.6
	3	21.4	21.5	21.4	21.4	21.4
	4	22.5	22.7	22.9	22.9	22.7
	5	21.3	21.4	21.6	21.7	21.5
	6	21.1	21.3	21.4	21.5	21.3
	7	22.2	22.4	22.6	22.6	22.4
	Total average					21.8

Table D232 : Measurements of globe temperature at Intensive Care Unit, Private hospital.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Intensive Care Unit	1	22.0	22.5	22.6	22.6	22.4
	2	22.3	22.6	22.9	23.4	22.8
	3	22.2	22.2	22.5	22.4	22.3
	4	23.9	23.9	23.8	23.8	23.8
	5	21.4	21.6	21.8	22.1	21.7
	6	22.7	22.9	23.2	23.3	23.0
	7	22.9	23.2	22.7	23.3	23.0
	Total average					22.7

Table D233 : Measurements of air velocity at A & E ward, Private hospital.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Accident & Emergency ward	1	0.68	0.60	0.50	0.36	0.53
	2	0.55	0.44	0.60	0.67	0.57
	3	0.58	0.57	0.46	0.53	0.53
	4	0.64	0.64	0.59	0.41	0.57
	5	0.60	0.44	0.54	0.57	0.54
	6	0.70	0.63	0.50	0.55	0.59
	7	0.70	0.52	0.63	0.67	0.63
	Total average					0.57

Table D234 : Measurements of air velocity at Labor ward, Private hospital.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Labor ward	1	0.57	0.51	0.42	0.31	0.45
	2	0.41	0.32	0.44	0.49	0.42
	3	0.44	0.43	0.35	0.40	0.40
	4	0.52	0.50	0.47	0.32	0.45
	5	0.46	0.34	0.41	0.43	0.41
	6	0.58	0.52	0.42	0.45	0.49
	7	0.54	0.40	0.48	0.51	0.48
	Total average					0.44

Table D235 : Measurements of air velocity at Delivery Suite, Private hospital.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Delivery Suite	1	0.68	0.62	0.52	0.38	0.55
	2	0.49	0.39	0.54	0.60	0.51
	3	0.64	0.63	0.51	0.59	0.59
	4	0.57	0.56	0.52	0.36	0.50
	5	0.60	0.44	0.54	0.57	0.54
	6	0.63	0.56	0.45	0.49	0.53
	7	0.58	0.43	0.52	0.55	0.52
	Total average					0.53

Table D236 : Measurements of air velocity at Intensive Care Unit, Private hospital.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Intensive Care Unit	1	0.48	0.37	0.45	0.29	0.40
	2	0.51	0.34	0.41	0.37	0.41
	3	0.46	0.40	0.35	0.40	0.40
	4	0.43	0.52	0.35	0.39	0.42
	5	0.50	0.43	0.38	0.40	0.43
	6	0.46	0.46	0.36	0.32	0.40
	7	0.43	0.46	0.31	0.40	0.40
	Total average					0.41

Table D237 : Measurements of relative humidity at A & E ward, Private hospital.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Accident & Emergency ward	1	62.4	62.6	62.0	62.0	62.2
	2	60.4	60.6	60.5	59.9	60.3
	3	61.1	61.2	61.2	61.3	61.2
	4	61.4	62.0	62.8	63.3	62.4
	5	62.3	62.3	62.1	62.9	62.4
	6	59.8	59.4	59.5	59.6	59.6
	7	62.0	62.0	61.8	62.6	62.1
	Total average					61.5

Table D238 : Measurements of relative humidity at Labor ward, Private hospital.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Labor ward	1	58.8	58.8	59.1	59.8	59.1
	2	76.3	75.5	73.2	72.1	74.3
	3	72.1	72.1	73.5	74.4	73.0
	4	65.8	65.3	64.9	64.8	65.2
	5	65.9	65.9	65.7	65.6	65.8
	6	66.2	66.0	66.2	66.2	66.1
	7	67.5	67.0	66.6	66.5	66.9
	Total average					67.2

Table D239 : Measurements of relative humidity at Delivery Suite, Private hospital.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Delivery Suite	1	65.3	65.2	65.6	66.3	65.6
	2	66.4	65.8	63.8	62.8	64.7
	3	63.7	63.7	65.0	65.8	64.5
	4	63.5	63.0	62.6	62.6	62.9
	5	67.3	67.3	67.0	66.9	67.1
	6	65.4	65.1	65.5	65.4	65.3
	7	66.8	66.3	65.9	65.8	66.2
	Total average					65.2

Table D240 : Measurements of relative humidity at Intensive Care Unit, Private hospital.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Private - Intensive Care Unit	1	71.9	72.0	71.4	71.4	71.7
	2	73.4	73.6	73.4	72.7	73.3
	3	73.3	73.5	73.5	73.6	73.5
	4	70.3	71.0	71.9	72.5	71.4
	5	70.3	70.3	70.0	71.0	70.4
	6	73.1	72.7	72.8	73.0	72.9
	7	76.5	76.5	76.2	77.2	76.6
	Total average					72.8

Table D241 : Measurements of metabolic rate at A & E ward, Private hospital.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Private - Accident & Emergency ward	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	0	0.0	
	Total		2	2.8	1.40

Table D242 : Measurements of metabolic rate at Labor ward, Private hospital.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Private - Labor ward	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	2	3.4	
	Total		2	3.4	1.70

Table D243 : Measurements of metabolic rate at Delivery Suite, Private hospital.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Private - Delivery Suite	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	3	5.1	
	Total		3	5.1	1.70

Table D244 : Measurements of metabolic rate at Intensive Care Unit, Private hospital.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Private - Intensive Care Unit	Seated quiet	1.0	0	0.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	4	5.6	
	Walking about	1.7	0	0.0	
	Total		4	5.6	1.40

Table D245 : Measurements of clothing value at A & E ward, Private hospital.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Private - Accident & Emergency ward	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	2	0.3	
	Socks	0.02	2	0.04	
	Shoes	0.02	2	0.04	
	Jacket	0.36	1	0.36	
	Overall	0.49	0	0.00	
	Total		2	1.18	0.59

Table D246 : Measurements of clothing value at Labor ward, Private hospital.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Private - Labor ward	Short-sleeve	0.19	2	0.38	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	2	0.30	
	Socks	0.02	2	0.04	
	Shoes	0.02	2	0.04	
	Jacket	0.36	0	0.00	
	Overall	0.49	0	0.00	
	Total		2	0.76	0.38

Table D247 : Measurements of clothing value at Delivery Suite, Private hospital.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Private - Delivery Suite	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	3	0.06	
	Shoes	0.02	3	0.06	
	Jacket	0.36	0	0.00	
	Overall	0.49	0	0.00	
	Total		3	1.14	0.38

Table D248 : Measurements of clothing value at Intensive Care Unit, Private hospital.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Private - Intensive Care Unit	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	4	0.08	
	Shoes	0.02	4	0.08	
	Jacket	0.36	0	0.00	
	Overall	0.49	0	0.00	
	Total		4	1.58	0.40

Table D249 : Measurements of AMV at A & E ward, Private hospital.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Private - Accident & Emergency ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		2	-4.0	-2.00

Table D250 : Measurements of AMV at Labor ward, Private hospital.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Private - Labor ward	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		2	-4.0	-2.00

Table D251 : Measurements of AMV at Delivery Suite, Private hospital.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Private - Delivery Suite	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		3	-3.0	-1.00

Table D252 : Measurements of AMV at Intensive Care Unit, Private hospital.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Private - Intensive Care Unit	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-4.0	-1.00

Table D253 : Measurements of air temperature at Hematologi lab, Kuala Kubu.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Hematologi lab	1	26.2	26.6	26.5	26.5	26.4
	2	26.0	26.2	26.3	26.7	26.3
	3	26.2	26.0	26.3	25.9	26.1
	4	26.3	26.0	26.0	25.7	26.0
	5	25.6	25.7	25.7	25.9	25.7
	6	25.6	25.7	25.7	25.6	25.7
	7	26.1	26.0	25.6	25.9	25.9
	Total average					26.0

Table D254 : Measurements of air temperature at Pharmacy, Kuala Kubu.

Hospital - Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Pharmacy	1	26.4	25.3	25.5	25.5	25.7
	2	25.7	25.8	25.6	25.5	25.7
	3	25.6	25.4	25.7	25.3	25.5
	4	25.9	25.6	24.9	25.4	25.5
	5	25.7	25.5	25.8	25.8	25.7
	6	24.6	24.7	24.8	24.9	24.7
	7	25.6	25.1	25.2	25.9	25.4
	8	24.7	23.7	23.8	23.8	24.0
	9	23.9	24.0	23.8	23.8	23.9
	10	23.9	24.0	23.9	23.7	23.9
	11	23.6	23.4	23.7	23.3	23.5
	12	23.7	23.4	22.8	23.2	23.3
	13	23.6	23.4	23.7	23.7	23.6
	14	23.4	23.5	23.6	23.7	23.5
	15	23.9	23.0	23.1	23.1	23.3
	Total average					24.5

Table D255 : Measurements of air temperature at X-Ray workstation, Kuala Kubu.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - X-Ray workstation	1	26.3	26.7	26.6	26.6	26.5
	2	26.9	27.1	27.2	27.7	27.2
	3	26.9	26.7	27.0	26.6	26.8
	4	27.9	27.6	27.6	27.3	27.6
	5	27.3	27.3	27.4	27.6	27.4
	6	27.6	27.7	27.7	27.6	27.7
	7	27.1	27.0	26.6	26.9	26.9
	8	26.9	27.3	27.2	27.2	27.1
	9	26.6	27.0	26.9	26.9	26.8
	10	26.5	26.7	26.8	27.3	26.8
	11	26.9	26.7	27.0	26.6	26.8
	12	26.5	26.2	26.2	25.9	26.2
	13	27.0	27.0	27.1	27.3	27.1
	14	25.9	26.0	26.0	25.9	26.0
	15	27.4	27.3	26.9	27.2	27.2
	Total average					26.9

Table D256 : Measurements of globe temperature at Hematologi lab, Kuala Kubu.

Hospital - Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Hematologi lab	1	26.9	26.0	26.4	26.4	26.4
	2	26.1	26.5	26.3	26.5	26.4
	3	26.1	25.9	26.5	26.5	26.2
	4	26.3	26.3	25.8	26.1	26.1
	5	25.4	25.4	25.9	26.3	25.8
	6	25.1	25.1	25.6	25.9	25.4
	7	25.8	25.6	25.8	26.5	25.9
	Total average					26.0

Table D257 : Measurements of globe temperature at Pharmacy, Kuala Kubu.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Pharmacy	1	26.2	25.3	25.7	25.7	25.7
	2	25.4	25.8	25.6	25.8	25.7
	3	25.5	25.3	25.9	25.9	25.6
	4	25.8	25.8	25.3	25.6	25.6
	5	25.3	25.3	25.8	26.2	25.7
	6	24.5	24.5	25.0	25.3	24.8
	7	25.3	25.1	25.3	26.0	25.4
	8	24.6	23.8	24.1	24.1	24.1
	9	23.6	23.9	23.7	23.9	23.8
	10	24.3	23.5	23.8	23.8	23.8
	11	23.3	23.6	23.4	23.6	23.5
	12	23.2	23.1	23.5	23.5	23.3
	13	23.8	23.8	23.3	23.6	23.6
	14	23.3	23.3	23.7	24.1	23.6
	15	23.2	23.2	23.7	24.0	23.5
	Total average					24.5

Table D258 : Measurements of globe temperature at X-Ray workstation, Kuala Kubu.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - X-Ray workstation	1	25.9	26.5	26.6	26.6	26.4
	2	26.6	27.0	27.3	27.8	27.2
	3	26.6	26.6	27.1	27.0	26.8
	4	27.6	27.6	27.5	27.5	27.5
	5	27.0	27.3	27.6	27.5	27.4
	6	27.4	27.6	27.9	27.8	27.7
	7	26.9	27.2	26.7	27.1	27.0
	8	26.6	27.2	27.3	27.3	27.1
	9	26.4	27.0	27.1	27.1	26.9
	10	26.3	26.7	27.0	27.6	26.9
	11	26.7	26.7	27.2	27.1	26.9
	12	26.0	26.0	25.9	25.9	25.9
	13	26.8	27.1	27.3	27.7	27.2
	14	25.7	25.9	26.2	26.1	26.0
	15	27.2	27.5	27.0	27.3	27.3
	Total average					26.9

Table D259 : Measurements of air velocity at Hematologi lab, Kuala Kubu.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Hematologi lab	1	0.27	0.18	0.14	0.16	0.19
	2	0.04	0.09	0.17	0.16	0.12
	3	0.12	0.17	0.15	0.25	0.17
	4	0.13	0.16	0.17	0.15	0.15
	5	0.15	0.15	0.21	0.32	0.21
	6	0.30	0.23	0.26	0.20	0.24
	7	0.29	0.19	0.14	0.17	0.20
	Total average					0.18

Table D260 : Measurements of air velocity at Pharmacy, Kuala Kubu.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Pharmacy	1	0.23	0.15	0.11	0.14	0.16
	2	0.04	0.09	0.17	0.16	0.12
	3	0.11	0.15	0.14	0.22	0.15
	4	0.13	0.16	0.17	0.15	0.15
	5	0.09	0.09	0.13	0.20	0.13
	6	0.16	0.12	0.14	0.11	0.13
	7	0.20	0.13	0.10	0.12	0.14
	8	0.04	0.09	0.17	0.16	0.12
	9	0.08	0.11	0.10	0.16	0.11
	10	0.05	0.06	0.07	0.06	0.06
	11	0.08	0.08	0.11	0.17	0.11
	12	0.13	0.09	0.11	0.08	0.10
	13	0.08	0.10	0.10	0.09	0.09
	14	0.08	0.08	0.11	0.17	0.11
	15	0.18	0.13	0.15	0.11	0.14
	Total average					0.12

Table D261 : Measurements of air velocity at X-Ray workstation, Kuala Kubu.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - X-Ray workstation	1	0.14	0.11	0.14	0.09	0.12
	2	0.09	0.06	0.07	0.05	0.07
	3	0.20	0.17	0.15	0.17	0.17
	4	0.06	0.08	0.05	0.06	0.06
	5	0.09	0.08	0.06	0.07	0.08
	6	0.14	0.13	0.10	0.09	0.11
	7	0.11	0.12	0.08	0.10	0.10
	8	0.08	0.07	0.08	0.05	0.07
	9	0.11	0.08	0.09	0.07	0.09
	10	0.08	0.06	0.05	0.06	0.06
	11	0.05	0.07	0.04	0.05	0.05
	12	0.09	0.08	0.06	0.07	0.08
	13	0.08	0.07	0.05	0.05	0.06
	14	0.05	0.06	0.04	0.05	0.05
	15	0.10	0.11	0.07	0.09	0.09
	Total average					0.08

Table D262 : Measurements of relative humidity at Hematologi lab, Kuala Kubu.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Hematologi lab	1	48.8	54.8	54.5	54.6	53.2
	2	52.2	52.0	52.9	54.2	52.8
	3	53.9	54.3	53.7	53.6	53.9
	4	52.9	53.9	54.6	54.6	54.0
	5	54.9	54.6	54.5	54.4	54.6
	6	56.0	55.2	55.6	54.7	55.4
	7	51.2	54.8	54.9	57.9	54.7
	Total average					54.1

Table D263 : Measurements of relative humidity at Pharmacy, Kuala Kubu.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - Pharmacy	1	50.6	56.9	56.6	56.7	55.2
	2	54.1	53.9	54.9	56.2	54.8
	3	55.6	56.0	55.4	55.3	55.6
	4	54.6	55.6	56.4	56.3	55.7
	5	55.5	55.2	55.1	55.0	55.2
	6	51.6	50.8	51.2	50.4	51.0
	7	46.4	49.7	49.8	52.5	49.6
	8	48.4	54.3	54.0	54.1	52.7
	9	51.8	51.6	52.5	53.8	52.4
	10	52.4	52.8	52.2	52.2	52.4
	11	52.8	53.8	54.5	54.5	53.9
	12	55.0	54.7	54.6	54.5	54.7
	13	54.8	54.0	54.4	53.6	54.2
	14	51.2	54.8	54.9	57.9	54.7
	15	56.0	55.2	55.6	54.7	55.4
	Total average					53.8

Table D264 : Measurements of relative humidity at X-Ray workstation, Kuala Kubu.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Kuala Kubu - X-Ray workstation	1	56.8	56.1	56.2	55.7	56.2
	2	54.2	55.4	54.2	54.6	54.6
	3	54.8	54.8	55.6	56.4	55.4
	4	53.5	53.4	53.4	53.4	53.4
	5	54.5	54.3	54.3	54.3	54.3
	6	54.1	54.4	54.8	54.3	54.4
	7	55.1	54.9	54.9	54.9	54.9
	8	52.8	53.1	53.5	53.0	53.1
	9	53.7	54.9	53.7	54.1	54.1
	10	52.9	52.9	53.6	54.3	53.4
	11	53.4	53.3	53.3	53.3	53.3
	12	54.9	54.7	54.7	54.7	54.7
	13	51.8	52.1	52.5	52.0	52.1
	14	55.1	54.9	54.9	54.9	54.9
	15	51.7	52.0	52.4	51.9	52.0
	Total average					54.1

Table D265 : Measurements of metabolic rate at Hematologi lab, Kuala Kubu.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Kuala Kubu - Hematologi lab	Seated quiet	1.0	0	0.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	0	0.0	
	Total		5	6.3	1.26

Table D266 : Measurements of metabolic rate at Pharmacy, Kuala Kubu.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Kuala Kubu - Pharmacy	Seated quiet	1.0	0	0.0	
	Typing	1.1	5	5.5	
	Standing relaxed	1.2	7	8.4	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		13	15.3	1.18

Table D267 : Measurements of metabolic rate at X-Ray workstation, Kuala Kubu.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Kuala Kubu - X-Ray workstation	Seated quiet	1.0	0	0.0	
	Typing	1.1	4	4.4	
	Standing relaxed	1.2	3	3.6	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		7	8	1.14

Table D268 : Measurements of clothing value at Hematologi lab, Kuala Kubu.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Kuala Kubu - Hematologi lab	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	1	0.02	
	Shoes	0.02	5	0.10	
	Jacket	0.36	3	1.08	
	Long-sleeved,thin sweater/vest	0.25	1	0.25	
	Total		5	2.70	0.54

Table D269 : Measurements of clothing value at Pharmacy, Kuala Kubu.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Kuala Kubu - Pharmacy	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	9	2.25	
	Normal trousers	0.15	13	1.95	
	Socks	0.02	8	0.16	
	Shoes	0.02	10	0.20	
	Jacket	0.36	3	1.08	
	Long-sleeved,thin sweater/vest	0.25	2	0.50	
	Total		13	6.71	0.52

Table D270 : Measurements of clothing value at X-Ray workstation, Kuala Kubu.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Kuala Kubu - X-Ray workstation	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	1	0.02	
	Shoes	0.02	4	0.08	
	Jacket	0.36	4	1.44	
	Long-sleeved,thin sweater/vest	0.25	3	0.75	
	Total		7	4.03	0.58

Table D271 : Measurements of AMV at Hematologi lab, Kuala Kubu.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Kuala Kubu - Hematologi lab	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	1	-2.0	
	Cold	-3	1	-3.0	
	Total		5	-7.0	-1.40

Table D272 : Measurements of AMV at Pharmacy, Kuala Kubu.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Kuala Kubu - Pharmacy	Hot	3	0	0.0	
	Warm	2	2	4.0	
	Slightly warm	1	2	2.0	
	Neutral	0	4	0.0	
	Slightly cool	-1	5	-5.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		13	1.0	0.08

Table D273 : Measurements of AMV at X-Ray workstation, Kuala Kubu.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Kuala Kubu - X-Ray workstation	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	7	7.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		7	7.0	1.00

Table D274 : Measurements of air temperature at Pathology Unit, Banting.

Hospital - Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pathology Unit	1	23.6	23.9	24.0	24.1	23.9
	2	23.9	24.0	24.0	24.1	24.0
	3	23.9	24.0	24.0	24.2	24.0
	4	24.1	23.9	23.7	23.9	23.9
	5	24.0	24.0	24.0	24.1	24.0
	6	22.9	23.2	23.1	22.9	23.0
	7	22.4	22.7	22.8	22.9	22.7
	8	23.0	23.1	23.1	23.2	23.1
	9	22.0	22.3	22.4	22.5	22.3
	10	22.4	22.5	22.5	22.6	22.5
	11	22.3	22.4	22.4	22.6	22.4
	12	22.2	22.0	21.8	22.0	22.0
	13	22.3	22.3	22.3	22.4	22.3
	14	21.7	22.0	21.9	21.7	21.8
	15	21.4	21.7	21.8	21.9	21.7
	16	21.8	21.9	21.9	22.0	21.9

	17	20.9	20.9	20.9	21.0	20.9
	18	21.3	21.6	21.5	21.3	21.4
	19	21.2	21.4	21.5	21.6	21.4
	20	20.9	21.0	21.0	21.1	21.0
	Total average					22.5

Table D275 : Measurements of air temperature at Pharmacy, Banting.

Hospital - Department	Sampling Point	T_{air} (^{o}C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pharmacy	1	23.6	22.7	22.8	22.8	23.0
	2	23.2	23.3	23.1	23.1	23.2
	3	23.5	23.3	23.6	23.2	23.4
	4	23.6	23.3	22.7	23.1	23.2
	5	22.8	22.6	22.9	22.9	22.8
	6	22.5	22.6	22.8	22.8	22.6
	7	23.3	22.9	23.0	23.6	23.2
	8	24.0	23.1	23.2	23.2	23.4
	9	23.3	23.4	23.2	23.2	23.3
	10	23.6	23.4	23.7	23.3	23.5
	11	23.6	23.3	22.7	23.1	23.2
	12	22.1	21.9	22.2	22.2	22.1
	13	22.6	22.7	22.9	22.9	22.7
	14	22.7	22.3	22.5	23.0	22.6
	15	23.0	22.1	22.2	22.2	22.4
	16	22.8	22.9	22.7	22.7	22.8
	17	23.0	22.8	23.1	22.7	22.9
	18	23.4	23.1	22.5	22.9	23.0
	19	23.1	22.9	23.2	23.2	23.1
	20	23.1	23.2	23.4	23.4	23.2
	Total average					23.0

Table D276 : Measurements of globe temperature at Pathology Unit, Banting.

Hospital - Department	Sampling Point	T_{globe} (^{o}C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pathology Unit	1	24.7	25.1	25.4	25.6	25.2
	2	24.9	25.2	25.5	25.6	25.3
	3	25.2	25.2	25.4	25.8	25.4
	4	25.3	25.3	25.2	25.5	25.3
	5	24.9	25.1	25.5	25.7	25.3
	6	25.0	25.2	25.3	25.2	25.2
	7	24.4	24.8	25.1	25.3	24.9
	8	25.0	25.3	25.6	25.7	25.4

	9	25.2	25.2	25.4	25.8	25.4
	10	24.2	24.6	24.9	25.1	24.7
	11	24.1	24.5	24.8	25.0	24.6
	12	24.8	25.1	25.4	25.5	25.2
	13	24.2	24.3	24.5	24.9	24.5
	14	25.0	25.0	24.9	25.2	25.0
	15	24.6	24.8	25.2	25.4	25.0
	16	24.0	24.1	24.2	24.1	24.1
	17	23.6	24.0	24.3	24.5	24.1
	18	24.3	24.6	24.9	25.0	24.7
	19	24.4	24.4	24.6	25.0	24.6
	20	23.8	24.2	24.5	24.7	24.3
	Total average					24.9

Table D277 : Measurements of globe temperature at Pharmacy, Banting.

Hospital - Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pharmacy	1	25.3	24.4	24.8	24.8	24.8
	2	24.7	25.1	24.9	25.1	25.0
	3	25.1	24.9	25.5	25.5	25.2
	4	25.2	25.2	24.7	25.1	25.0
	5	24.1	24.1	24.6	25.0	24.5
	6	24.1	24.1	24.6	24.9	24.4
	7	24.9	24.7	24.9	25.5	25.0
	8	25.7	24.8	25.2	25.2	25.2
	9	24.7	25.1	24.9	25.1	25.0
	10	24.9	24.9	25.4	25.7	25.2
	11	25.4	24.5	24.9	24.9	24.9
	12	24.6	25.0	24.8	25.0	24.9
	13	24.4	24.3	24.8	24.8	24.5
	14	24.5	24.5	24.0	24.4	24.3
	15	23.8	23.8	24.3	24.7	24.2
	16	24.3	24.3	24.8	25.1	24.6
	17	24.6	24.4	24.6	25.2	24.7
	18	25.4	24.5	24.9	24.9	24.9
	19	24.6	25.0	24.8	25.0	24.9
	20	24.8	24.8	25.3	25.6	25.1
	Total average					24.8

Table D278 : Measurements of air velocity at Pathology Unit, Banting.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pathology Unit	1	0.32	0.24	0.29	0.32	0.29
	2	0.32	0.31	0.28	0.22	0.28
	3	0.44	0.28	0.25	0.36	0.33
	4	0.36	0.30	0.28	0.17	0.28
	5	0.17	0.16	0.38	0.37	0.27
	6	0.36	0.27	0.27	0.30	0.30
	7	0.28	0.21	0.26	0.28	0.26
	8	0.30	0.30	0.27	0.22	0.27
	9	0.30	0.20	0.18	0.26	0.24
	10	0.35	0.27	0.25	0.15	0.25
	11	0.16	0.15	0.35	0.34	0.25
	12	0.31	0.23	0.23	0.26	0.26
	13	0.36	0.27	0.33	0.36	0.33
	14	0.34	0.34	0.31	0.25	0.31
	15	0.35	0.23	0.20	0.29	0.27
	16	0.38	0.32	0.30	0.18	0.30
	17	0.21	0.19	0.45	0.45	0.33
	18	0.40	0.30	0.30	0.33	0.33
	19	0.30	0.24	0.29	0.32	0.29
	20	0.30	0.31	0.28	0.22	0.28
	Total average					0.29

Table D279 : Measurements of air velocity at Pharmacy, Banting.

Hospital - Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pharmacy	1	0.13	0.08	0.06	0.08	0.09
	2	0.03	0.07	0.13	0.12	0.09
	3	0.03	0.04	0.04	0.06	0.04
	4	0.04	0.04	0.05	0.04	0.04
	5	0.12	0.12	0.17	0.26	0.17
	6	0.08	0.06	0.06	0.05	0.06
	7	0.14	0.09	0.07	0.09	0.10
	8	0.05	0.09	0.19	0.18	0.13
	9	0.06	0.08	0.07	0.12	0.08
	10	0.05	0.06	0.07	0.06	0.06
	11	0.03	0.03	0.04	0.06	0.04
	12	0.06	0.05	0.05	0.04	0.05
	13	0.06	0.04	0.03	0.03	0.04
	14	0.02	0.04	0.09	0.08	0.06
	15	0.06	0.08	0.07	0.12	0.08
	16	0.12	0.15	0.16	0.14	0.14

	17	0.14	0.14	0.20	0.30	0.20
	18	0.14	0.10	0.12	0.09	0.11
	19	0.20	0.13	0.10	0.12	0.14
	20	0.04	0.08	0.16	0.15	0.11
	Total average					0.09

Table D280 : Measurements of relative humidity at Pathology Unit, Banting.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pathology Unit	1	59.8	59.9	59.4	59.4	59.6
	2	59.5	59.7	59.5	58.9	59.4
	3	59.3	59.4	59.4	59.5	59.4
	4	58.6	59.1	59.9	60.4	59.5
	5	59.2	59.2	59.0	59.8	59.3
	6	61.3	60.9	61.0	61.2	61.1
	7	60.8	60.8	60.6	61.4	60.9
	8	63.0	63.1	62.5	62.5	62.8
	9	62.1	62.3	62.1	61.5	62.0
	10	62.6	62.7	62.7	62.8	62.7
	11	62.9	63.5	64.3	64.8	63.9
	12	63.0	63.0	62.8	63.6	63.1
	13	63.8	63.4	63.5	63.7	63.6
	14	63.8	63.8	63.6	64.4	63.9
	15	63.9	64.0	63.4	63.4	63.7
	16	64.7	64.9	64.7	64.1	64.6
	17	63.7	63.8	63.8	63.9	63.8
	18	62.6	63.2	64.0	64.5	63.6
	19	64.5	64.5	64.3	65.1	64.6
	20	64.0	63.6	63.7	63.9	63.8
	Total average					62.3

Table D281 : Measurements of relative humidity at Pharmacy, Banting.

Hospital - Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
Banting - Pharmacy	1	52.7	59.1	58.8	58.9	57.4
	2	56.7	56.5	57.5	58.9	57.4
	3	57.0	57.5	56.8	56.7	57.0
	4	55.4	56.4	57.3	57.2	56.6
	5	57.6	57.3	57.2	57.1	57.3
	6	58.2	57.3	57.7	56.8	57.5
	7	53.7	57.4	57.5	60.6	57.3
	8	52.3	58.7	58.4	58.5	57.0
	9	55.7	55.5	56.5	57.9	56.4

	10	56.5	56.9	56.3	56.2	56.5
	11	55.2	56.2	57.1	57.0	56.4
	12	57.8	57.5	57.4	57.3	57.5
	13	58.3	57.4	57.8	56.9	57.6
	14	52.8	59.3	59.1	59.1	57.6
	15	57.1	56.9	57.9	59.3	57.8
	16	57.8	58.3	57.6	57.5	57.8
	17	56.4	57.4	58.3	58.2	57.6
	18	58.3	58.0	57.9	57.8	58.0
	19	58.4	57.5	57.9	57.0	57.7
	20	53.7	57.5	57.6	60.7	57.4
	Total average					57.3

Table D282 : Measurements of metabolic rate at Pathology Unit, Banting.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Banting - Pathology Unit	Seated quiet	1.0	0	0.0	
	Typing	1.1	3	3.3	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	2	3.4	
	Total		7	9.1	1.30

Table D283 : Measurements of metabolic rate at Pharmacy, Banting.

Hospital - Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
Banting - Pharmacy	Seated quiet	1.0	0	0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	0	0	
	Walking about	1.7	0	0	
	Total		2	2.3	1.15

Table D284 : Measurements of clothing value at Pathology Unit, Banting.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Banting - Pathology Unit	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	4	1.00	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	6	0.12	
	Shoes	0.02	7	0.14	
	Jacket	0.36	0	0.00	
	Long-sleeved,thin sweater/vest	0.25	2	0.50	
	Total		7	3.38	0.48

Table D285 : Measurements of clothing value at Pharmacy, Banting.

Hospital - Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
Banting - Pharmacy	Short-sleeve	0.19	1	0.19	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	2	0.30	
	Socks	0.02	2	0.04	
	Shoes	0.02	2	0.04	
	Jacket	0.36	1	0.36	
	Long-sleeved,thin sweater/vest	0.25	0	0.00	
	Total		2	1.18	0.59

Table D286 : Measurements of AMV at Pathology Unit, Banting.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Banting - Pathology Unit	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		7	-5.0	-0.71

Table D287 : Measurements of AMV at Pharmacy, Banting.

Hospital - Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
Banting - Pharmacy	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		2	-2.0	-1.00

Table D288 : UMMC (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Pharmacy	0.12	5	Comfortable	in	23.5	24.8	0	0	17	73	-0.5	21.9	22.0
Otorinolaringologi	-0.48	10	Comfortable	in	23.0	22.2	-0.1	-0.1	12	69	-0.4	21.9	22.2
Oftalmologi	-0.75	17	Comfortable	below	22.7,cool	22.0	-0.2	-0.2	12	73	-0.4	21.9	22.2
Emergency Consultation Hall	-0.53	11	Comfortable	below	22.3,cool	21.6	-0.1	-0.1	16	80	-0.9	21.9	21.4
Observation ward	-0.89	22	Comfortable	below	21.6,cool	20.4	-0.2	-0.2	17	89	-1.1	21.9	21.1

Table D289 : Putrajaya (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Pediatric ward	-0.04	5	comfortable	in	24.3	23.2	-0.1	-0.1	11	52	-0.1	21.9	22.9
Orthopedic ward	-0.33	7	comfortable	in	23.3	22.3	-0.1	-0.1	13	66	-0.4	21.9	22.5
Female medical ward	-0.01	5	comfortable	in	25.3	24.1	0	0	12	36	-0.4	21.9	22.5
Pharmacy	-0.25	6	comfortable	in	22.7	23.3	-0.1	-0.1	19	86	-0.5	21.9	22.1
X-ray & radiography	-0.29	7	comfortable	in	21.5	23.7	0	0	28	100	-0.8	21.9	21.5
Out-patient pharmacy	-0.11	5	comfortable	in	22.2	23.7	0	0	21	92	-0.7	21.9	22.0
Day care unit	-0.34	7	comfortable	in	21.9	22.9	-0.1	-0.1	26	100	-0.8	21.9	21.8

Table D290 : Sungai Buloh (Outputs from ASHRAE Thermal Comfort Prograı

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Outpatient pharmacy	-0.61	13	comfortable	below	21.5,cool	22.8	-0.1	-0.1	16 draft risk	92	-0.8	21.9	21.6
Pathodology unit	0.55	11	comfortable	above	22.5,cool	26.2	0.1	0.3	16	86	-0.7	21.9	21.7
X-Ray workstation	0.79	18	slightly uncomfortable	above	23.1	29.9	0.6	1.3	14	81	-0.5	21.9	22.2
Pediatric ward	0	5	comfortable	in	23.5	23.1	-0.1	-0.1	13	66	-0.4	21.9	22.4
Maternity ward	0.17	6	comfortable	in	22.0,cool	24.1	0	0	13	81	-0.7	21.9	21.8

Table D291 : Selayang (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Outpatient pharmacy	0.51	10	slightly uncomfortable	above	20.9,cool	28.3	0.4	0.7	17	100	-1.2	21.9	21.0
Pediatric ward	0.02	5	comfortable	in	23.9	23.5	0	0	15	66	-0.3	21.9	22.6
Maternity ward	0.80	19	slightly uncomfortable	above	25.9	27.6	0.4	0.7	19	58	0.2	21.9	23.5
Pathodology unit	0.27	7	comfortable	in	23.8	26.0	0.1	0.2	14	66	-0.3	21.9	22.5
X-ray workstation	0.29	7	comfortable	in	22.1	26.8	0.2	0.4	16 draft risk	88	-0.8	21.9	21.6

Table D292 : Klang (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Picture Archiving Communication	-0.27	6	comfortable	in	24.4	23.1	-0.1	-0.1	25	79	-0.1	21.9	23.0
Pathology	-0.20	6	comfortable	in	23.0	24.0	0	0	36	100	-0.5	21.9	22.4
X-ray & radiography	0.65	14	comfortable	above	26.0, warm, too humid	26.3	0.2	0.4	15	55	0.3	21.9	23.4
Cytology laboratory	-0.47	10	comfortable	in	20.9, cool	22.7	-0.1	-0.1	87	100	-1.1	21.9	21.4
Endoscopy	-0.35	8	comfortable	in	21.0, cool	20.5	-0.1	-0.1	15	93	-0.9	21.9	21.3
Medical day care	-0.16	6	comfortable	in	22.5, cool	22.4	-0.1	-0.1	13	75	-0.6	21.9	22.0

Table D293 : Kajang (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Clinic	-0.33	7	comfortable	in	25.4	24.1	-0.1	-0.1	16 draft risk	54	0.2	21.9	23.5
Haemodialisis	0.70	15	comfortable	above	26.2, warm	26.8	0.3	0.5	14	47	0.3	21.9	23.7
Pharmacy	0.41	8	comfortable	in	25.4	24.8	0	0	17	57	0.2	21.9	23.4
X-ray & radiography	0.06	5	comfortable	in	23.5	24.7	0	0	25	88	-0.4	21.9	22.6

Table D294 : Private (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Accident & Emergency ward	-0.89	22	comfortable	below	21.8	21.2	-0.2	-0.2	100	100	-0.8	21.9	21.7
Labor ward	-0.53	11	comfortable	below	22.6	21.7	-0.1	-0.1	67	100	-0.5	21.9	22.1
Delivery Suite	-0.82	19	comfortable	below	22.0, cool	20.6	-0.1	-0.1	90	100	-0.7	21.9	21.8
Intensive Care Unit	-0.94	24	comfortable	below	23.0	21.1	-0.1	-0.1	60	100	-0.4	21.9	22.2

Table D295 : Kuala Kubu (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Hematologi lab	0.47	10	comfortable	in	26.1, warm	26.0	0.2	0.3	16	49	0.3	21.9	23.8
Pharmacy	-0.06	5	comfortable	in	24.6	24.1	0	0	12	53	-0.1	21.9	23.1
X-Ray workstation	0.66	14	comfortable	above	27.0, warm, too humid	26.9	0.4	0.5	8	16	0.6	21.9	24.2

Table D296 : Banting (Outputs from ASHRAE Thermal Comfort Program)

Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Pathology Unit	-0.26	6	comfortable	in	25.3	24.4	0	0	40	79	-0.5	21.9	22.1
Pharmacy	-0.08	5	comfortable	in	24.8	24.6	0	0	12	44	-0.4	21.9	22.4

Appendix E : Graphs of actual mean vote versus operative temperature for hospitals

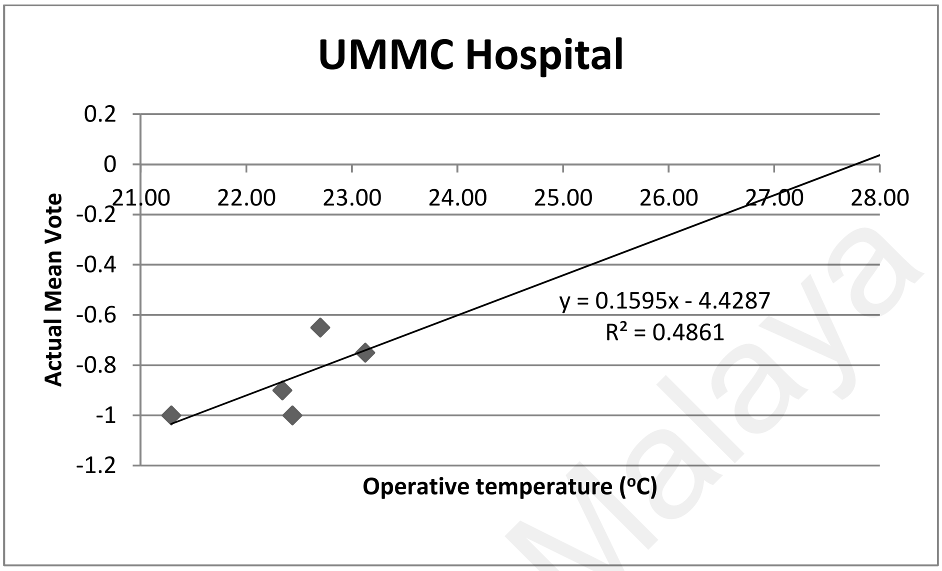

Figure E1 : AMV vs T_{op} for UMMC hospital.

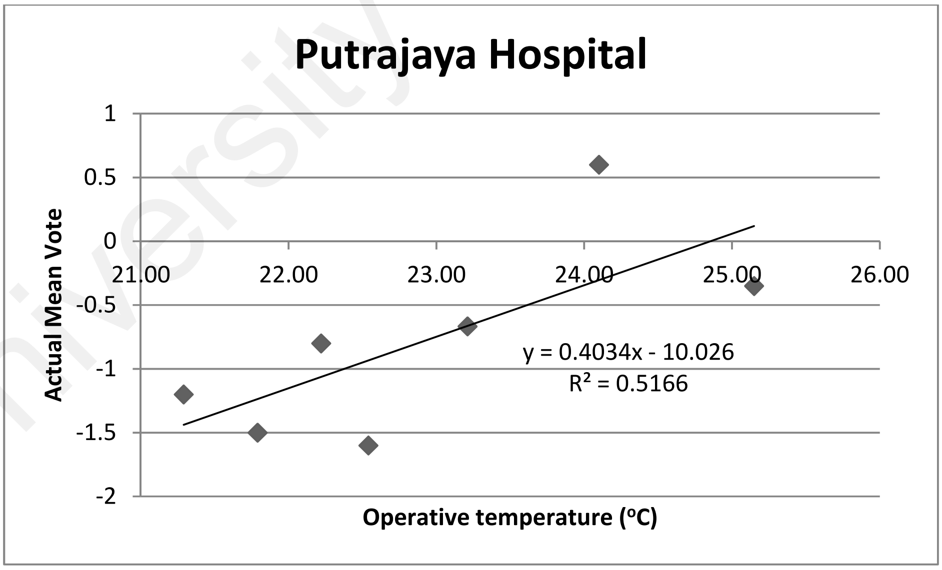

Figure E2 : AMV vs T_{op} for Putrajaya hospital.

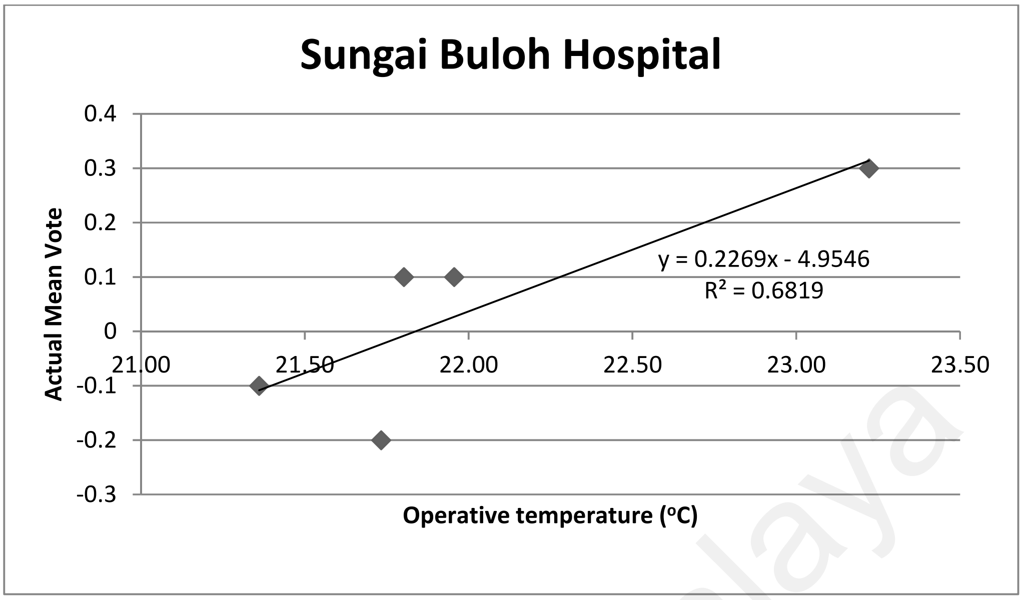

Figure E3 : AMV vs T_{op} for Sungai Buloh hospital.

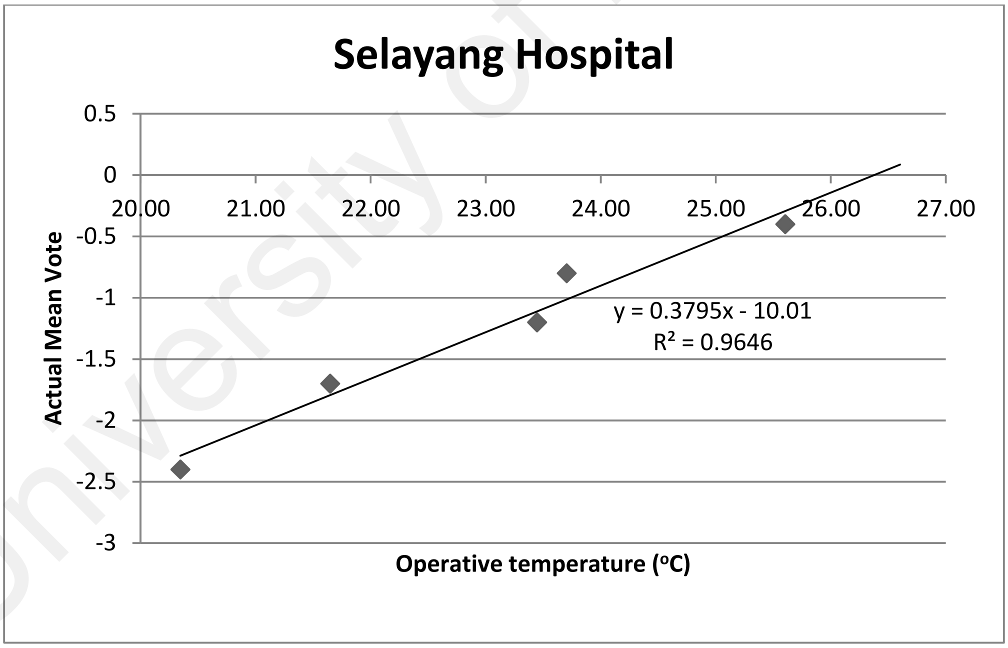

Figure E4 : AMV vs T_{op} for Selayang hospital.

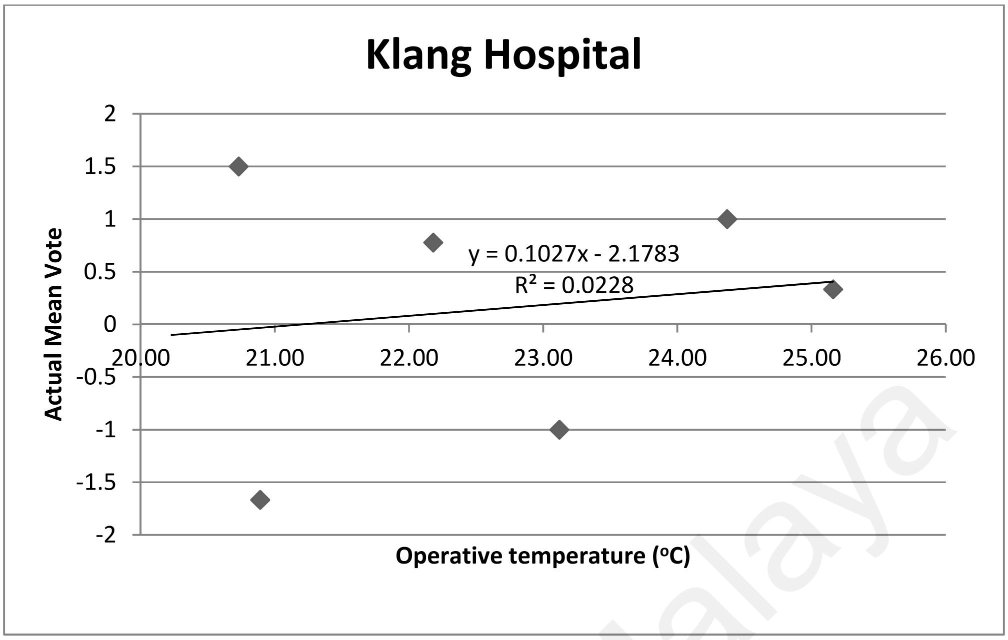

Figure E5 : AMV vs T_{op} for Klang hospital.

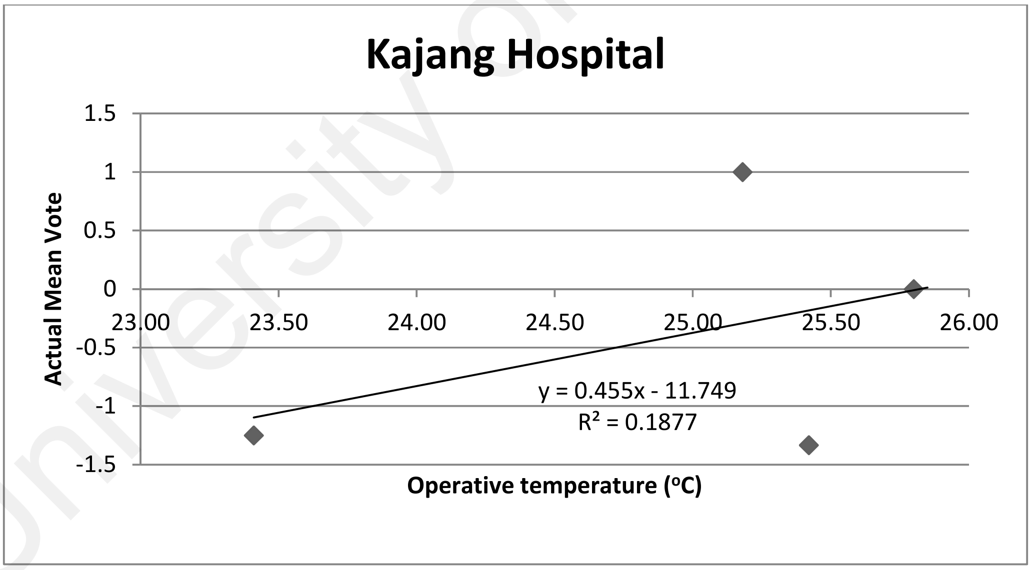

Figure E6 : AMV vs T_{op} for Kajang hospital.

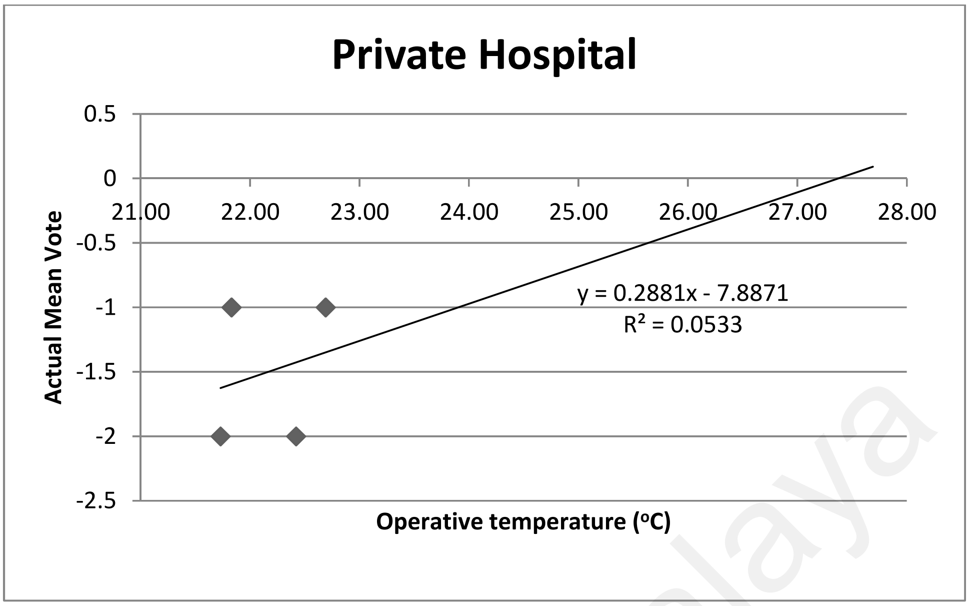

Figure E7 : AMV vs T_{op} for Private hospital.

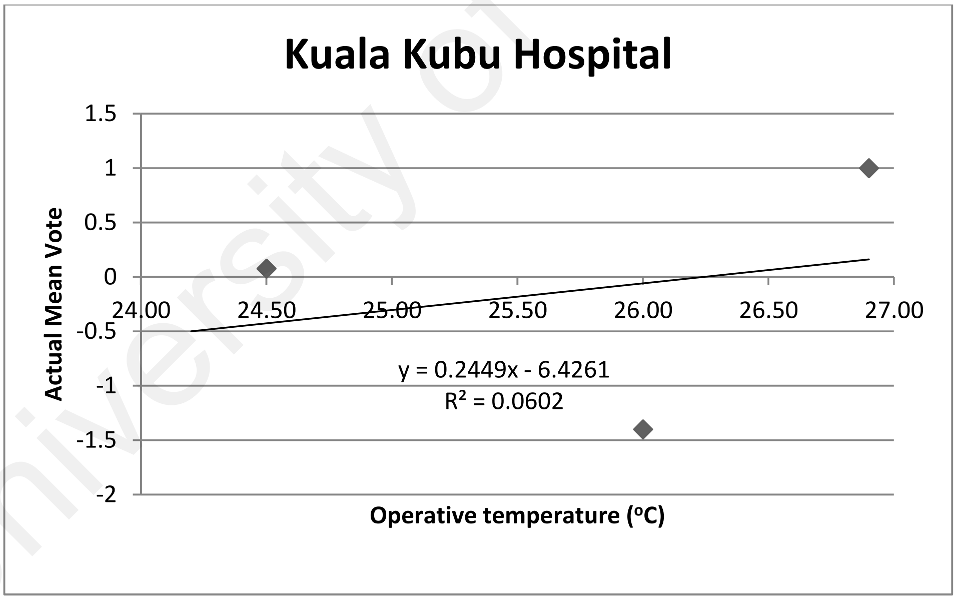

Figure E8 : AMV vs T_{op} for Kuala Kubu hospital.

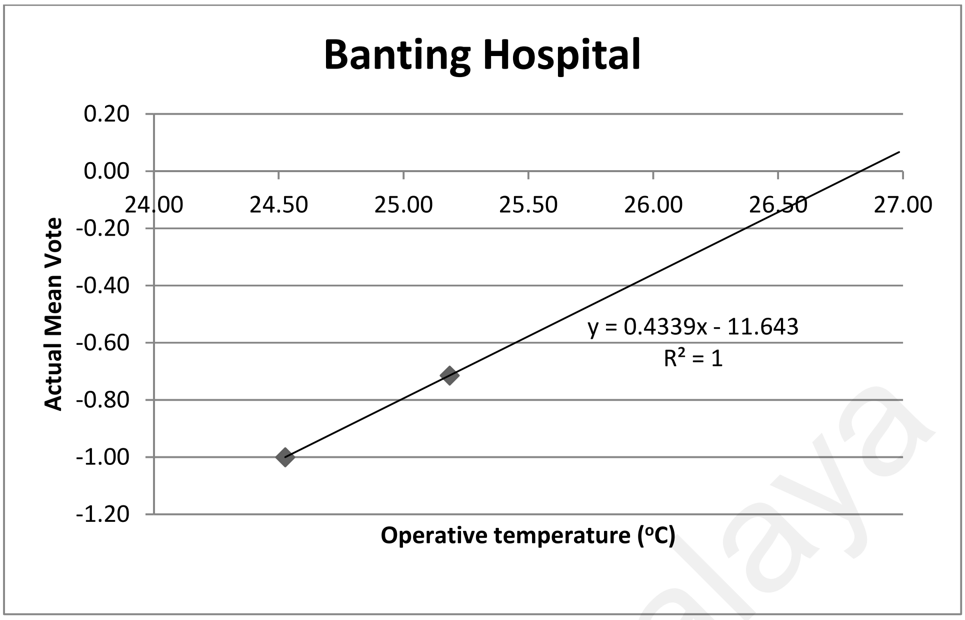

Figure E9 : AMV vs T_{op} for Banting hospital.

Appendix F : Residual analysis for hospitals

No.	Explanatory variable, T_{out} (°C)	Response variable, T_n (°C)	Fitted value, T_n (°C)	Residual, e = Response variable - Fitted value
1	32.10	27.77	25.50	2.27
2	29.33	24.85	24.58	0.28
3	29.43	21.84	24.61	-2.78
4	31.02	26.38	25.14	1.24
5	33.33	21.22	25.90	-4.68
6	33.65	25.82	26.01	-0.19
7	33.53	27.38	25.97	1.41
8	31.30	26.24	25.23	1.01
9	31.80	26.83	25.40	1.44

Appendix G : Bias uncertainty analysis for hospitals

Table G1 : Bias uncertainty analysis for UMMC - Pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.10	23.0	22.3	69.3	30.5
2	0.10	23.0	22.4	69.3	31.5
3	0.10	23.1	22.7	70.2	32.6
4	0.18	23.2	22.0	70.5	31.6
5	0.18	23.2	21.8	71.1	31.1
6	0.14	23.2	21.9	73.3	33.9
7	0.10	23.3	22.2	79.1	32.6
8	0.13	23.2	22.3	80.6	32.1
9	0.18	23.3	22.1	84.3	33.0
Average	0.13	23.2	22.2	74.2	32.1
Bias Uncertainty	0.01	0.03	0.10	1.67	0.38
Error (%)	6.64	0.14	0.45	2.25	1.18

Table G2 : Bias uncertainty analysis for
UMMC - Otorinolaringologi ward

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.06	22.5	22.5	85.7	32.5
2	0.10	22.5	22.9	77.2	32.4
3	0.06	22.6	22.9	73.7	33.2
4	0.07	22.7	22.8	73.9	30.7
5	0.06	22.7	22.5	74.8	31.6
6	0.08	22.8	22.8	75.9	32.3
7	0.11	22.8	22.6	75.7	33.3
8	0.06	22.9	22.4	72.6	32.5
Average	0.07	22.7	22.7	76.2	32.3
Bias Uncertainty	0.01	0.05	0.06	1.64	0.33
Error (%)	8.47	0.22	0.28	2.15	1.01

Table G3 : Bias uncertainty analysis for UMMC - Oftalmologi ward

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.12	22.2	22.1	74.4	32.3
2	0.13	22.3	22.3	73.5	32.9
3	0.13	22.4	22.0	73.7	32.6
4	0.12	22.3	22.1	75.4	32.9
5	0.06	22.4	23.1	79.2	31.3
6	0.12	22.4	23.3	71.9	32.8
7	0.06	22.5	23.4	72.9	30.1
8	0.06	22.5	23.3	71.6	32.2
9	0.13	22.6	22.8	71.5	32.5
Average	0.10	22.4	22.7	73.8	32.2
Bias Uncertainty	0.01	0.04	0.16	0.86	0.31
Error (%)	7.61	0.20	0.69	1.16	0.97

Table G4 : Bias uncertainty analysis for UMMC - Emergency Consultation Hall

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.06	22.9	23.1	66.5	33.1
2	0.14	22.8	21.6	69.7	30.5
3	0.06	22.7	21.3	71.6	32.6
4	0.14	22.5	20.8	74.1	33.2
5	0.08	22.4	20.8	73.8	32.4
6	0.10	22.3	20.5	75.4	33.1
7	0.14	22.3	20.5	75.7	30.4
8	0.13	22.4	20.5	75.5	32.9
9	0.11	22.3	20.3	75.3	30.8
Average	0.11	22.5	21.0	73.1	32.1
Bias Uncertainty	0.01	0.07	0.31	1.02	0.31
Error (%)	8.38	0.30	1.48	1.40	0.97

Table G5 : Bias uncertainty analysis for UMMC - Observation ward

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.12	21.4	20.5	74.9	29.4
2	0.12	21.4	20.4	75.7	30.2
3	0.10	21.4	20.5	75.1	31.5
4	0.14	21.4	20.4	75.4	31.9
5	0.13	21.5	20.3	75.3	32.8
6	0.08	21.4	20.2	75.4	32.5
7	0.09	21.4	20.2	75.7	32.7
8	0.08	21.4	20.3	75.5	32.4
9	0.16	21.3	20.1	75.7	32.6
Average	0.11	21.4	20.3	75.4	31.8
Bias Uncertainty	0.01	0.02	0.04	0.09	0.38
Error (%)	7.92	0.10	0.22	0.12	1.19

Table G6 : Bias uncertainty analysis for Putrajaya - Pediatric ward

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.07	24.0	24.1	64.1	27.9
2	0.05	24.1	24.1	65.6	28.0
3	0.05	24.1	24.2	65.5	28.9
4	0.08	24.2	24.1	63.6	28.2
5	0.06	24.1	24.0	63.0	28.4
Average	0.06	24.1	24.1	64.4	28.3
Bias Uncertainty	0.01	0.04	0.04	0.52	0.20
Error (%)	9.68	0.17	0.17	0.81	0.71

Table G7 : Bias uncertainty analysis for Putrajaya - Orthopedic ward

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.10	23.3	23.7	57.9	27.7
2	0.09	23.2	23.6	56.9	28.1
3	0.14	23.1	23.4	56.6	28.7
4	0.10	23.1	23.3	56.4	28.9
5	0.12	23.2	23.2	56.4	28.3
6	0.09	23.1	23.1	56.6	29.4
7	0.12	23.3	23.1	56.3	29.6
Average	0.11	23.2	23.3	56.7	28.7
Bias Uncertainty	0.01	0.03	0.09	0.23	0.27
Error (%)	6.64	0.12	0.37	0.40	0.95

Table G8 : Bias uncertainty analysis for
Putrajaya - Female medical ward

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.05	23.6	23.3	52.3	28.9
2	0.06	24.9	23.3	53.1	28.9
3	0.08	25.9	23.4	53.3	29.4
4	0.07	26.1	23.4	54.0	29.2
5	0.08	26.3	23.4	54.4	29.1
6	0.09	26.1	23.3	53.9	29.2
7	0.05	26.2	23.3	55.0	29.9
Average	0.07	25.6	23.3	53.7	29.2
Bias Uncertainty	0.01	0.39	0.01	0.39	0.14
Error (%)	8.28	1.51	0.06	0.72	0.49

Table G9 : Bias uncertainty analysis for
Putrajaya - Pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.12	22.3	22.3	68.4	29.2
2	0.13	23.0	22.8	61.1	29.5
3	0.15	22.4	22.7	64.2	29.4
4	0.16	22.1	22.5	64.3	29.4
5	0.18	22.6	22.3	68.3	29.9
Average	0.15	22.5	22.5	65.3	29.5
Bias Uncertainty	0.01	0.18	0.10	1.46	0.14
Error (%)	8.11	0.80	0.44	2.24	0.47

Table G10 : Bias uncertainty analysis for
Putrajaya - X-ray & radiography

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.20	21.1	21.8	72.3	29.9
2	0.18	21.6	21.6	63.7	29.0
3	0.23	21.3	21.1	68.7	29.6
4	0.20	21.3	21.0	68.4	30.5
5	0.18	21.4	21.2	68.8	30.1
Average	0.20	21.3	21.3	68.4	29.8
Bias Uncertainty	0.01	0.10	0.16	1.72	0.30
Error (%)	5.05	0.47	0.75	2.52	1.01

Table G11 : Bias uncertainty analysis for
Putrajaya - Out-patient pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.18	22.2	22.3	49.2	29.9
2	0.14	22.2	22.2	54.1	29.5
3	0.13	22.6	22.5	56.6	29.4
4	0.17	21.9	21.8	56.1	30.7
5	0.16	22.2	22.2	49.7	30.2
Average	0.16	22.2	22.2	53.1	29.9
Bias Uncertainty	0.01	0.14	0.14	1.48	0.26
Error (%)	6.41	0.63	0.63	2.79	0.87

Table G12 : Bias uncertainty analysis for
Putrajaya - Day care unit

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.17	21.7	21.8	62.2	29.2
2	0.16	22.1	22.1	55.3	29.8
3	0.18	21.9	21.8	54.3	29.8
4	0.20	21.2	21.2	54.9	30.2
5	0.22	22.1	22.0	57.7	30.7
Average	0.19	21.8	21.8	56.9	29.9
Bias Uncertainty	0.01	0.18	0.18	1.58	0.30
Error (%)	6.45	0.83	0.83	2.78	1.00

Table G13 : Bias uncertainty analysis for Sungai Buloh - Outpatient pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.08	22.3	22.6	68.2	29.9
2	0.14	21.6	21.3	69.0	29.9
3	0.11	21.4	21.1	67.7	30.2
4	0.11	21.1	20.8	66.3	29.9
5	0.16	21.8	23.6	67.3	30.5
6	0.08	20.1	19.9	68.2	30.7
7	0.16	21.4	21.1	66.1	31.0
Average	0.12	21.4	21.5	67.5	30.3
Bias Uncertainty	0.01	0.31	0.53	0.41	0.16
Error (%)	9.52	1.47	2.46	0.61	0.52

Table G14 : Bias uncertainty analysis for
Sungai Buloh - Pathodology unit

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.09	22.3	22.2	76.5	31.5
2	0.10	24.6	24.7	57.6	31.6
3	0.16	22.2	21.9	70.4	26.4
4	0.10	21.6	21.3	72.4	26.7
5	0.16	19.9	19.3	72.1	25.7
6	0.09	20.7	20.4	72.8	25.7
7	0.17	21.5	21.2	70.7	24.1
Average	0.12	21.8	21.6	70.4	27.4
Bias Uncertainty	0.01	0.67	0.77	2.70	1.07
Error (%)	9.20	3.08	3.58	3.84	3.91

Table G15 : Bias uncertainty analysis for
Sungai Buloh - X-Ray workstation

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.09	22.4	22.1	68.0	28.5
2	0.14	21.8	21.6	69.4	28.0
3	0.10	21.5	22.6	70.3	28.1
4	0.11	21.6	22.5	69.6	30.2
5	0.15	22.2	23.6	67.2	32.0
6	0.09	21.9	23.6	69.2	32.2
Average	0.11	21.9	22.6	68.9	29.8
Bias Uncertainty	0.01	0.15	0.33	0.52	0.70
Error (%)	8.82	0.69	1.47	0.75	2.35

Table G16 : Bias uncertainty analysis for
Sungai Buloh - Pediatric ward

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.10	22.5	22.3	73.1	31.9
2	0.11	22.3	22.1	71.9	31.2
3	0.10	22.5	22.2	69.4	30.2
4	0.11	22.1	21.8	67.1	30.0
5	0.16	26.9	26.7	65.8	28.0
6	0.10	23.2	23.0	62.7	28.1
Average	0.11	23.3	23.0	68.3	29.9
Bias Uncertainty	0.01	0.80	0.82	1.73	0.65
Error (%)	8.82	3.44	0.82	2.54	2.18

Table G17 : Bias uncertainty analysis for
Sungai Buloh - Maternity ward

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.13	23.0	23.0	59.4	28.5
2	0.09	21.9	22.0	63.5	28.0
3	0.09	21.1	21.2	67.0	28.1
4	0.09	21.2	21.4	67.2	30.2
5	0.11	21.8	21.8	62.3	32.0
6	0.08	21.4	21.7	64.4	32.2
Average	0.10	21.7	21.8	64.0	29.8
Bias Uncertainty	0.01	0.32	0.30	1.30	0.70
Error (%)	8.47	1.46	1.37	2.03	2.35

Table G18 : Bias uncertainty analysis for Selayang - Outpatient pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.14	20.8	20.6	62.2	28.1
2	0.15	19.8	19.6	65.1	26.8
3	0.10	19.6	19.4	65.3	27.8
4	0.09	19.0	18.7	67.1	26.5
5	0.10	20.7	20.5	60.4	28.3
6	0.09	21.0	21.0	60.3	28.0
7	0.08	21.8	21.5	65.4	28.7
Average	0.11	20.4	20.2	63.7	27.7
Bias Uncertainty	0.01	0.40	0.40	0.97	0.31
Error (%)	9.33	1.96	1.98	1.53	1.13

Table G19 : Bias uncertainty analysis for
Selayang - Pediatric ward

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.13	25.2	25.0	60.3	29.2
2	0.14	23.9	23.7	59.9	30.2
3	0.16	23.2	22.9	60.8	31.0
4	0.09	23.3	23.0	60.3	31.5
5	0.16	23.1	22.9	61.4	31.9
6	0.10	23.6	23.3	63.8	32.7
Average	0.13	23.7	23.5	61.1	31.1
Bias Uncertainty	0.01	0.35	0.35	0.65	0.58
Error (%)	8.97	1.48	1.49	1.06	1.88

Table G20 : Bias uncertainty analysis for Selayang - Maternity ward

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.16	24.4	24.2	61.4	32.1
2	0.22	26.4	26.1	56.9	32.4
3	0.15	25.3	25.1	54.1	32.6
4	0.25	25.6	25.3	54.5	32.7
5	0.17	26.5	26.3	55.6	32.7
6	0.27	25.4	25.1	55.5	32.5
Average	0.20	25.6	25.4	56.3	32.5
Bias Uncertainty	0.02	0.35	0.35	1.22	0.10
Error (%)	9.84	1.37	1.38	2.16	0.31

Table G21 : Bias uncertainty analysis for Selayang - Pathodology unit

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.11	24.2	24.0	62.1	32.1
2	0.10	23.8	23.5	57.7	31.9
3	0.12	24.0	23.7	62.7	32.6
4	0.13	22.8	22.6	74.3	32.8
5	0.16	23.8	23.5	55.2	32.2
6	0.10	22.3	22.1	75.6	32.5
Average	0.12	23.5	23.2	64.6	32.4
Bias Uncertainty	0.01	0.32	0.32	3.40	0.15
Error (%)	8.33	1.35	0.82	5.27	0.46

Table G22 : Bias uncertainty analysis for Selayang - X-ray workstation

Point	V (m/s)	T_{globe} (°C)	T_{air} (°C)	RH (%)	T_{out} (°C)
1	0.15	22.2	21.9	64.8	32.5
2	0.12	23.1	22.9	61.4	32.3
3	0.08	22.6	22.3	64.7	32.3
4	0.12	20.8	20.5	72.9	32.4
5	0.13	20.8	20.6	71.3	31.4
6	0.10	21.1	21.1	69.0	29.8
7	0.13	21.2	20.9	70.8	29.4
Average	0.12	21.7	21.5	67.8	31.4
Bias Uncertainty	0.01	0.33	0.34	1.64	0.44
Error (%)	8.43	1.52	1.60	2.42	1.41

Table G23 : Bias uncertainty analysis for
Klang - Picture Archiving Communication

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.24	24.3	24.5	49.4	31.5
2	0.23	24.4	24.7	50.1	33.7
3	0.20	23.0	23.7	49.6	33.0
4	0.19	24.5	24.3	49.8	32.1
5	0.25	25.1	24.5	51.2	33.9
6	0.26	24.9	24.7	53.4	34.2
7	0.21	24.5	24.1	51.0	34.4
Average	0.23	24.4	24.4	50.6	33.3
Bias Uncertainty	0.01	0.30	0.14	0.57	0.41
Error (%)	4.43	1.23	0.59	1.13	1.25

Table G24 : Bias uncertainty analysis for
Klang - Pathology

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.28	23.6	23.5	42.7	34.3
2	0.31	22.8	23.1	45.2	33.0
3	0.27	22.8	23.0	47.4	33.7
4	0.28	22.7	22.8	47.8	31.0
5	0.27	23.7	23.4	47.9	32.7
6	0.29	22.9	22.9	47.1	32.7
7	0.23	23.1	22.9	46.3	34.0
Average	0.28	23.1	23.1	46.3	33.1
Bias Uncertainty	0.01	0.14	0.10	0.74	0.47
Error (%)	4.15	0.62	0.43	1.60	1.43

Table G25 : Bias uncertainty analysis for
Klang - X-ray & radiography

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.15	25.5	25.3	69.6	34.0
2	0.14	24.8	24.7	70.7	34.4
3	0.17	25.8	25.3	72.1	33.5
4	0.14	26.0	26.3	74.0	33.5
5	0.19	25.0	25.4	64.0	33.7
6	0.12	25.4	25.3	72.3	33.6
7	0.16	25.2	25.1	69.1	31.2
8	0.16	24.0	24.6	70.3	33.0
Average	0.16	25.2	25.2	70.3	33.4
Bias Uncertainty	0.01	0.25	0.21	1.25	0.40
Error (%)	5.64	0.99	0.84	1.78	1.20

Table G26 : Bias uncertainty analysis for Klang - Cytology laboratory

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.40	19.6	19.8	49.1	29.6
2	0.49	21.1	20.9	48.1	30.7
3	0.46	21.1	20.7	48.5	32.9
4	0.54	20.9	21.2	46.6	35.0
5	0.49	20.5	20.9	47.9	33.8
6	0.48	21.1	21.2	47.0	35.4
7	0.54	21.6	21.2	47.7	32.6
8	0.53	21.3	20.9	47.7	34.5
Average	0.49	20.9	20.9	47.8	33.1
Bias Uncertainty	0.02	0.25	0.18	0.31	0.73
Error (%)	3.56	1.20	0.84	0.65	2.19

Table G27 : Bias uncertainty analysis for Klang - Endoscopy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.07	20.1	20.2	75.2	30.0
2	0.04	19.8	19.8	76.5	32.3
3	0.04	20.2	20.3	74.7	32.2
4	0.04	20.5	20.5	74.6	33.1
5	0.06	20.5	20.3	74.7	33.8
6	0.04	20.3	20.1	76.1	34.3
7	0.06	21.7	22.4	72.9	35.8
8	0.04	22.4	22.2	73.0	36.3
Average	0.05	20.7	20.7	74.7	33.5
Bias Uncertainty	0.00	0.33	0.33	0.45	0.79
Error (%)	7.89	1.57	1.57	0.60	2.35

Table G28 : Bias uncertainty analysis for Klang - Medical day care

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.04	19.6	19.7	77.4	30.3
2	0.04	23.3	23.2	68.6	32.4
3	0.09	21.3	21.5	73.6	33.0
4	0.05	22.2	22.1	71.9	33.6
5	0.05	22.5	22.6	70.7	34.5
6	0.06	22.7	23.0	69.5	34.0
7	0.09	23.5	23.2	68.7	34.6
8	0.04	23.7	23.4	68.2	34.3
9	0.04	23.7	23.3	67.9	34.8
10	0.08	19.7	19.8	76.4	34.6
Average	0.06	22.2	22.2	71.3	33.6

Bias Uncertainty	0.01	0.41	0.37	0.95	0.45
Error (%)	8.62	1.85	1.67	1.33	1.34

Table G29 : Bias uncertainty analysis for Kajang - Clinic

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.17	25.3	25.4	53.6	31.9
2	0.15	25.5	25.5	52.3	32.5
3	0.15	25.2	25.3	50.9	33.4
4	0.18	25.4	25.3	51.9	33.9
5	0.16	25.5	25.4	53.5	34.1
6	0.19	25.4	25.5	52.4	34.3
Average	0.17	25.4	25.4	52.4	33.4
Bias Uncertainty	0.01	0.05	0.03	0.45	0.40
Error (%)	4.00	0.20	0.13	0.86	1.20

Table G30 : Bias uncertainty analysis for
Kajang - Haemodialisis

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.16	25.6	25.7	58.2	32.3
2	0.15	25.3	25.5	58.9	32.7
3	0.19	25.6	25.7	59.4	33.8
4	0.16	25.8	25.8	60.3	34.3
5	0.17	26.1	25.9	59.5	33.9
6	0.15	26.2	26.0	58.9	35.1
Average	0.16	25.8	25.8	59.2	33.7
Bias Uncertainty	0.01	0.15	0.08	0.35	0.47
Error (%)	4.08	0.58	0.32	0.59	1.39

Table G31 : Bias uncertainty analysis for
Kajang - Pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.15	24.6	25.2	57.7	32.5
2	0.16	25.0	25.3	57.0	33.3
3	0.18	25.9	25.2	57.6	33.8
4	0.17	25.1	25.2	58.3	34.1
5	0.18	25.1	25.1	57.3	34.3
6	0.20	25.3	25.2	59.0	34.6
Average	0.17	25.2	25.2	57.8	33.8
Bias Uncertainty	0.01	0.22	0.03	0.33	0.35
Error (%)	4.81	0.86	0.13	0.58	1.04

Table G32 : Bias uncertainty analysis for Kajang - X-ray & radiography

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.23	22.5	23.2	49.8	32.8
2	0.21	22.9	22.9	51.2	33.7
3	0.24	23.6	23.3	52.9	33.7
4	0.23	23.9	23.6	53.5	34.3
5	0.20	23.9	23.7	54.2	33.6
6	0.17	23.7	23.5	57.5	34.1
Average	0.21	23.4	23.4	53.2	33.7
Bias Uncertainty	0.01	0.23	0.13	1.28	0.25
Error (%)	5.48	1.00	0.82	2.41	0.74

Table G33 : Bias uncertainty analysis for Private - Accident & Emergency ward

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.53	20.4	20.5	62.2	31.1
2	0.57	21.8	21.6	60.3	32.8
3	0.53	21.6	21.4	61.2	33.5
4	0.57	24.2	23.9	62.4	34.5
5	0.54	19.0	20.3	62.4	33.8
6	0.59	23.1	22.8	59.6	35.2
7	0.63	22.1	21.8	62.1	34.0
Average	0.57	21.7	21.7	61.5	33.6
Bias Uncertainty	0.01	0.74	0.51	0.40	0.59
Error (%)	2.53	3.42	2.36	0.65	1.75

Table G34 : Bias uncertainty analysis for Private - Labor ward

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.45	24.4	24.4	59.1	32.1
2	0.42	20.9	20.9	74.3	32.9
3	0.40	21.1	21.1	73.0	33.5
4	0.45	20.5	20.5	65.2	33.8
5	0.41	23.5	23.4	65.8	33.2
6	0.49	23.1	23.0	66.1	34.1
7	0.48	23.3	23.2	66.9	34.5
Average	0.44	22.4	22.4	67.2	33.4
Bias Uncertainty	0.01	0.56	0.56	2.17	0.34
Error (%)	2.90	2.49	2.49	3.23	1.03

Table G35 : Bias uncertainty analysis for Private - Delivery Suite

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.55	20.8	20.4	65.6	31.9
2	0.51	22.6	22.3	64.7	32.2
3	0.59	21.4	21.3	64.5	33.7
4	0.50	22.7	22.9	62.9	33.5
5	0.54	21.5	21.8	67.1	34.2
6	0.53	21.3	21.9	65.3	34.1
7	0.52	22.4	22.3	66.2	34.7
Average	0.53	21.8	21.8	65.2	33.5
Bias Uncertainty	0.01	0.27	0.36	0.60	0.40
Error (%)	2.41	1.24	1.63	0.92	1.20

Table G36 : Bias uncertainty analysis for Private - Intensive Care Unit

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.40	22.4	22.5	71.7	32.1
2	0.41	22.8	22.9	73.3	32.3
3	0.40	22.3	22.3	73.5	33.2
4	0.42	23.8	23.7	71.4	33.7
5	0.43	21.7	21.6	70.4	34.2
6	0.40	23.0	22.9	72.9	34.6
7	0.40	23.0	23.1	76.6	34.8
Average	0.41	22.7	22.7	72.8	33.6
Bias Uncertainty	0.00	0.30	0.30	0.89	0.39
Error (%)	1.05	1.32	0.82	1.22	1.15

Table G37 : Bias uncertainty analysis for Kuala Kubu - Hematologi lab

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.19	26.4	26.4	53.2	30.2
2	0.12	26.4	26.3	52.8	30.9
3	0.17	26.2	26.1	53.9	31.0
4	0.15	26.1	26.0	54.0	31.5
5	0.21	25.8	25.7	54.6	32.0
6	0.24	25.4	25.7	55.4	32.1
7	0.20	25.9	25.9	54.7	32.0
Average	0.18	26.0	26.0	54.1	31.4
Bias Uncertainty	0.02	0.14	0.10	0.37	0.27
Error (%)	9.38	0.55	0.38	0.69	0.86

Table G38 : Bias uncertainty analysis for
Kuala Kubu - Pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.16	25.7	25.7	55.2	29.6
2	0.12	25.7	25.7	54.8	32.3
3	0.15	25.6	25.5	55.6	33.1
4	0.15	25.6	25.5	55.7	33.5
5	0.13	25.7	25.7	55.2	32.4
6	0.13	24.8	24.7	51.0	32.3
7	0.14	25.4	25.4	49.6	31.3
8	0.12	24.1	24.0	52.7	29.4
9	0.11	23.8	23.9	52.4	30.6
10	0.06	23.8	23.9	52.4	30.5
11	0.11	23.5	23.5	53.9	29.8
12	0.10	23.3	23.3	54.7	29.8
13	0.09	23.6	23.6	54.2	30.4
14	0.11	23.6	23.5	54.7	31.5
15	0.14	23.5	23.3	55.4	31.6
Average	0.12	24.5	24.5	53.8	31.2
Bias Uncertainty	0.01	0.16	0.16	0.41	0.27
Error (%)	5.49	0.65	0.65	0.76	0.88

Table G39 : Bias uncertainty analysis for
Kuala Kubu - X-Ray workstation

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.12	26.4	26.5	56.2	29.3
2	0.07	27.2	27.2	54.6	30.9
3	0.17	26.8	26.8	55.4	29.9
4	0.06	27.5	27.6	53.4	31.1
5	0.08	27.4	27.4	54.3	30.5
6	0.11	27.7	27.7	54.4	31.2
7	0.10	27.0	26.9	54.9	31.8
8	0.07	27.1	27.1	53.1	31.6
9	0.09	26.9	26.8	54.1	31.2
10	0.06	26.9	26.8	53.4	31.4
11	0.05	26.9	26.8	53.3	31.3
12	0.08	25.9	26.2	54.7	32.0
13	0.06	27.2	27.1	52.1	32.1
14	0.05	26.0	26.0	54.9	32.3
15	0.09	27.3	27.2	52.0	33.6
Average	0.08	26.9	26.9	54.1	31.3
Bias Uncertainty	0.01	0.12	0.11	0.28	0.29
Error (%)	9.52	0.45	0.42	0.52	0.91

Table G40 : Bias uncertainty analysis for Banting - Pathology Unit

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.29	25.2	23.9	59.6	31.9
2	0.28	25.3	24.0	59.4	32.6
3	0.33	25.4	24.0	59.4	33.5
4	0.28	25.3	23.9	59.5	33.7
5	0.27	25.3	24.0	59.3	33.4
6	0.30	25.2	23.0	61.1	33.3
7	0.26	24.9	22.7	60.9	32.2
8	0.27	25.4	23.1	62.8	30.7
9	0.24	25.4	22.3	62.0	31.0
10	0.25	24.7	22.5	62.7	31.1
11	0.25	24.6	22.4	63.9	29.9
12	0.26	25.2	22.0	63.1	30.5
13	0.33	24.5	22.3	63.6	31.8
14	0.31	25.0	21.8	63.9	31.6
15	0.27	25.0	21.7	63.7	31.8
16	0.30	24.1	21.9	64.6	32.3
17	0.33	24.1	20.9	63.8	30.4
18	0.33	24.7	21.4	63.6	31.4
19	0.29	24.6	21.4	64.6	32.1
20	0.28	24.3	21.0	63.8	31.8
Average	0.29	24.9	22.5	62.3	31.9
Bias Uncertainty	0.00	0.06	0.16	0.27	0.19
Error (%)	1.57	0.26	0.69	0.43	0.60

Table G41 : Bias uncertainty analysis for Banting - Pharmacy

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.09	24.8	23.0	57.4	29.9
2	0.09	25.0	23.2	57.4	31.6
3	0.04	25.2	23.4	57.0	32.7
4	0.04	25.0	23.2	56.6	32.8
5	0.17	24.5	22.8	57.3	32.8
6	0.06	24.4	22.6	57.5	32.7
7	0.10	25.0	23.2	57.3	31.8
8	0.13	25.2	23.4	57.0	30.0
9	0.08	25.0	23.3	56.4	31.3
10	0.06	25.2	23.5	56.5	31.4
11	0.04	24.9	23.2	56.4	29.8
12	0.05	24.9	22.1	57.5	29.6
13	0.04	24.5	22.7	57.6	31.4
14	0.06	24.3	22.6	57.6	31.7
15	0.08	24.2	22.4	57.8	31.8
16	0.14	24.6	22.8	57.8	31.5
17	0.20	24.7	22.9	57.6	32.1
18	0.11	24.9	23.0	58.0	32.6
19	0.14	24.9	23.1	57.7	33.5
20	0.11	25.1	23.2	57.4	32.8
Average	0.09	24.8	23.0	57.3	31.7
Bias Uncertainty	0.01	0.05	0.07	0.08	0.20
Error (%)	8.74	0.20	0.30	0.14	0.62

Appendix H : Detail measurements for offices.

Table H1 : Measurements of air temperature at Office A – Level 1.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 1	1	26.8	26.5	26.4	26.4	26.5
	2	26.7	26.8	26.5	26.3	26.6
	3	26.2	25.8	25.9	26.0	26.0
	4	25.8	25.9	25.9	26.0	25.9
	5	25.6	25.6	25.5	25.5	25.6
	6	25.6	25.6	25.6	25.6	25.6
	7	25.8	25.7	25.8	25.8	25.8
	8	25.7	25.8	25.8	25.8	25.8
	9	26.0	26.1	25.9	25.7	25.9
	10	25.8	26.0	26.1	26.0	26.0
	11	26.4	26.1	26.0	26.0	26.1
	12	26.1	26.2	25.9	25.7	26.0
	13	26.3	26.0	26.0	26.1	26.1
	14	25.9	26.0	26.0	26.1	26.0
	15	26.4	26.2	26.2	26.2	26.3
	Total average					26.0

Table H2 : Measurements of air temperature at Office A – Level 2.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 2	1	26.7	26.4	26.3	26.3	26.4
	2	26.8	27.0	26.6	26.4	26.7
	3	26.7	26.4	26.3	26.5	26.5
	4	26.6	26.7	26.7	26.8	26.7
	5	26.6	26.5	26.5	26.5	26.5
	6	26.5	26.5	26.5	26.5	26.5
	7	26.4	26.3	26.4	26.4	26.4
	8	26.2	26.3	26.3	26.3	26.3
	9	26.5	26.6	26.4	26.2	26.4
	10	26.1	26.3	26.4	26.3	26.3
	11	26.6	26.3	26.2	26.2	26.3
	12	26.3	26.5	26.1	25.9	26.2
	13	26.5	26.2	26.1	26.3	26.3
	14	26.1	26.2	26.2	26.3	26.2
	15	26.4	26.3	26.3	26.3	26.3
	16	26.1	26.1	26.1	26.1	26.1
	17	26.2	26.1	26.2	26.2	26.2
	Total average					26.4

Table H3 : Measurements of globe temperature at Office A – Level 1.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 1	1	23.9	23.8	23.9	23.9	23.9
	2	23.9	23.9	23.9	23.9	23.9
	3	23.9	23.9	23.9	23.9	23.9
	4	23.9	23.9	24.0	23.9	23.9
	5	23.9	23.9	23.9	23.8	23.9
	6	23.9	23.9	23.9	23.9	23.9
	7	23.9	23.9	23.9	23.9	23.9
	8	23.9	23.9	23.9	23.9	23.9
	9	24.0	23.9	23.9	23.9	23.9
	10	23.9	23.9	23.9	23.9	23.9
	11	23.9	23.9	23.9	23.9	23.9
	12	23.9	23.9	23.9	23.9	23.9
	13	23.9	23.9	23.9	23.8	23.9
	14	23.9	23.9	23.9	23.9	23.9
	15	23.9	23.9	23.8	23.9	23.9
	Total average					23.9

Table H4 : Measurements of globe temperature at Office A – Level 2.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 2	1	24.3	24.3	24.3	24.2	24.3
	2	24.3	24.3	24.2	24.3	24.3
	3	24.3	24.3	24.3	24.3	24.3
	4	24.3	24.3	24.3	24.3	24.3
	5	24.4	24.3	24.3	24.3	24.3
	6	24.3	24.3	24.3	24.3	24.3
	7	24.3	24.2	24.3	24.3	24.3
	8	24.3	24.3	24.3	24.3	24.3
	9	24.3	24.3	24.3	24.3	24.3
	10	24.3	24.3	24.3	24.3	24.3
	11	24.3	24.4	24.3	24.3	24.3
	12	24.3	24.3	24.3	24.3	24.3
	13	24.3	24.3	24.4	24.3	24.3
	14	24.3	24.3	24.3	24.3	24.3
	15	24.3	24.3	24.3	24.3	24.3
	16	24.4	24.3	24.3	24.3	24.3
	17	24.3	24.3	24.3	24.2	24.3
	Total average					24.3

Table H5 : Measurements of air velocity at Office A – Level 1.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 1	1	0.04	0.04	0.04	0.04	0.04
	2	0.01	0.01	0.02	0.01	0.01
	3	0.02	0.01	0.01	0.02	0.02
	4	0.02	0.01	0.01	0.01	0.01
	5	0.02	0.03	0.01	0.02	0.02
	6	0.02	0.02	0.02	0.01	0.02
	7	0.02	0.01	0.01	0.01	0.01
	8	0.01	0.01	0.02	0.01	0.01
	9	0.02	0.01	0.01	0.01	0.01
	10	0.01	0.02	0.01	0.01	0.01
	11	0.01	0.01	0.01	0.01	0.01
	12	0.01	0.01	0.02	0.01	0.01
	13	0.01	0.01	0.01	0.01	0.01
	14	0.01	0.02	0.01	0.01	0.01
	15	0.02	0.03	0.01	0.02	0.02
	Total average					0.02

Table H6 : Measurements of air velocity at Office A – Level 2.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 2	1	0.03	0.02	0.02	0.02	0.02
	2	0.03	0.01	0.01	0.03	0.02
	3	0.02	0.04	0.04	0.02	0.03
	4	0.03	0.02	0.01	0.01	0.02
	5	0.02	0.03	0.02	0.02	0.02
	6	0.04	0.04	0.04	0.04	0.04
	7	0.02	0.02	0.02	0.02	0.02
	8	0.07	0.04	0.04	0.08	0.06
	9	0.02	0.03	0.02	0.01	0.02
	10	0.02	0.03	0.01	0.02	0.02
	11	0.03	0.02	0.02	0.02	0.02
	12	0.03	0.01	0.01	0.03	0.02
	13	0.01	0.03	0.03	0.01	0.02
	14	0.03	0.02	0.01	0.01	0.02
	15	0.02	0.03	0.02	0.02	0.02
	16	0.03	0.01	0.01	0.03	0.02
	17	0.04	0.08	0.08	0.04	0.06
	Total average					0.03

Table H7 : Measurements of relative humidity at Office A – Level 1.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 1	1	44.9	45.4	45.6	47.4	45.8
	2	56.6	56.9	56.8	57.1	56.9
	3	57.0	57.5	57.3	57.3	57.3
	4	57.8	57.7	58.4	58.2	58.0
	5	58.8	58.6	58.6	58.9	58.7
	6	60.0	59.7	59.2	59.0	59.5
	7	60.6	60.4	60.6	60.3	60.5
	8	61.0	60.4	60.1	60.6	60.5
	9	60.3	60.5	60.1	61.1	60.5
	10	58.8	59.9	60.2	60.3	59.8
	11	58.8	59.5	59.7	62.0	60.0
	12	58.4	58.7	58.6	59.0	58.7
	13	59.5	60.0	59.8	59.8	59.8
	14	57.7	57.6	58.4	58.1	57.9
	15	58.2	58.0	58.0	58.3	58.1
	Total average					58.1

Table H8 : Measurements of relative humidity at Office A – Level 2.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A - Level 2	1	60.2	60.5	60.4	60.8	60.5
	2	59.2	59.7	59.5	59.5	59.5
	3	59.5	59.4	60.3	60.0	59.8
	4	59.5	59.3	59.3	59.6	59.4
	5	61.0	60.8	60.2	60.0	60.5
	6	61.2	61.0	61.2	60.9	61.1
	7	61.7	61.1	60.8	61.3	61.2
	8	61.7	61.9	61.5	62.5	61.9
	9	60.3	61.4	61.9	62.0	61.4
	10	61.1	61.6	61.4	61.4	61.4
	11	60.7	60.6	61.5	61.2	61.0
	12	61.0	60.8	60.8	61.1	60.9
	13	61.5	61.2	60.6	60.4	60.9
	14	59.7	59.5	59.7	59.4	59.6
	15	60.2	59.6	59.3	59.8	59.7
	16	59.6	59.8	59.4	60.4	59.8
	17	58.7	59.8	60.3	60.4	59.8
	Total average					60.5

Table H9 : Measurements of metabolic rate at Office A – Level 1.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Level 1	Seated quiet	1.0	7	7.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	0	0.0	
	Total		10	11.0	1.10

Table H10 : Measurements of metabolic rate at Office A – Level 2.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Level 2	Seated quiet	1.0	11	11.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		14	14.8	1.06

Table H11 : Measurements of clothing value at Office A – Level 1.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Level 1	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	10	2.50	
	Normal trousers	0.15	10	1.50	
	Socks	0.02	10	0.20	
	Shoes	0.02	10	0.20	
	Jacket	0.36	1	0.36	
	Total		10	4.76	0.48

Table H12 : Measurements of clothing value at Office A – Level 2.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Level 2	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	10	2.50	
	Normal trousers	0.15	13	1.95	
	Socks	0.02	13	0.26	
	Shoes	0.02	14	0.28	
	Jacket	0.36	1	0.36	
	Full slip	0.16	1	0.16	
	Skirt thin	0.14	1	0.14	
	Total		14	6.41	0.46

Table H13 : Measurements of AMV at Office A – Level 1.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Level 1	Hot	3	0	0.0	
	Warm	2	4	8.0	
	Slightly warm	1	1	1.0	
	Neutral	0	3	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		10	7.0	0.70

Table H14 : Measurements of AMV at Office A – Level 2.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Level 2	Hot	3	1	3.0	
	Warm	2	4	8.0	
	Slightly warm	1	4	4.0	
	Neutral	0	4	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		14	14.0	1.00

Table H15 : Measurements of air temperature at Office B – Level 8.

Office - Level / Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 8	1	21.8	21.8	21.8	21.7	21.8
	2	21.8	21.8	21.8	21.8	21.8
	3	21.8	21.7	21.7	21.7	21.7
	4	22.0	21.9	21.9	21.9	21.9
	5	22.3	22.3	22.3	22.1	22.3
	6	22.2	22.2	22.2	22.2	22.2
	7	22.1	22.1	22.0	22.0	22.1
	8	21.2	21.1	21.1	21.1	21.1
	9	21.0	21.1	21.1	21.1	21.1
	10	21.0	20.9	20.9	20.9	20.9
	Total average					21.7

Table H16 : Measurements of air temperature at Office B – Level 14.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 14	1	20.8	20.8	20.8	20.6	20.8
	2	21.0	20.9	20.9	20.9	20.9
	3	20.9	20.9	20.9	20.8	20.9
	4	21.2	21.1	21.1	21.1	21.1
	5	21.4	21.3	21.3	21.2	21.3
	6	21.2	21.2	21.3	21.3	21.3
	7	21.0	21.1	21.1	21.0	21.1
	8	20.8	20.8	20.8	20.8	20.8
	9	20.7	20.5	20.5	20.4	20.5
	10	20.5	20.5	20.5	20.5	20.5
	11	19.7	19.6	19.6	19.6	19.6
	Total average					20.8

Table H17 : Measurements of air temperature at Office B – Level 17.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 17	1	22.1	22.1	22.0	21.8	22.0
	2	21.7	21.7	21.7	21.7	21.7
	3	21.6	21.7	21.7	21.6	21.7
	4	21.2	21.2	21.2	21.3	21.2
	5	21.3	21.3	21.3	21.4	21.3
	6	21.2	21.3	21.3	21.3	21.3
	7	21.3	21.2	21.2	21.2	21.2
	8	21.5	21.4	21.4	21.4	21.4
	9	21.6	21.8	21.7	21.7	21.7
	10	22.2	22.1	22.1	22.1	22.1
	11	22.4	22.3	22.3	22.3	22.3
	12	22.6	22.5	22.5	22.5	22.5
	13	22.7	22.7	22.7	22.7	22.7
	14	22.8	22.8	22.8	22.8	22.8
	15	22.9	22.8	22.9	22.8	22.9
	16	22.6	22.5	22.6	22.5	22.6
	17	22.6	22.6	22.6	22.5	22.6
	18	22.5	22.6	22.5	22.5	22.5
	Total average					22.0

Table H18 : Measurements of air temperature at Office B – Level 21.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 21	1	23.0	23.0	23.1	23.0	23.0
	2	22.7	22.7	22.8	22.7	22.7
	3	22.5	22.6	22.6	22.6	22.6
	4	22.4	22.4	22.5	22.5	22.5
	Total average					22.7

Table H19 : Measurements of globe temperature at Office B – Level 8.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 8	1	23.2	22.5	22.8	22.8	22.8
	2	22.6	22.9	22.7	22.9	22.8
	3	22.8	22.7	23.1	23.1	22.9
	4	23.1	23.1	22.6	23.0	22.9
	5	22.5	22.5	22.9	23.2	22.8
	6	22.2	22.2	22.7	23.0	22.5
	7	22.4	22.2	22.4	22.9	22.4
	8	23.2	22.5	22.8	22.8	22.8
	9	23.0	23.3	23.1	23.3	23.2
	10	22.8	22.7	23.1	23.1	22.9
	Total average					22.8

Table H20 : Measurements of globe temperature at Office B – Level 14.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 14	1	22.2	22.6	22.9	23.1	22.7
	2	22.4	22.6	22.8	22.9	22.7
	3	22.4	22.6	22.8	23.2	22.8
	4	22.9	22.9	22.8	23.1	22.9
	5	22.3	22.5	22.9	23.1	22.7
	6	22.1	22.4	22.5	22.4	22.4
	7	21.9	22.2	22.5	22.7	22.3
	8	22.4	22.7	22.8	22.9	22.7
	9	22.4	22.6	22.8	23.2	22.8
	10	22.6	22.6	22.5	22.8	22.6
	11	22.7	22.9	23.2	23.4	23.1
	Total average					22.7

Table H21 : Measurements of globe temperature at Office B – Level 17.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 17	1	23.1	22.4	22.7	22.7	22.7
	2	22.5	22.8	22.6	22.8	22.7
	3	22.8	22.6	23.1	23.1	22.9
	4	23.2	23.2	22.7	23.2	23.1
	5	22.6	22.6	23.0	23.3	22.9
	6	22.1	22.1	22.6	22.9	22.4
	7	22.3	22.1	22.3	22.7	22.3
	8	22.4	22.8	23.1	23.2	22.9
	9	22.7	23.0	23.2	23.3	23.1
	10	22.7	22.7	22.9	23.3	22.9
	11	23.1	23.1	23.0	23.3	23.1
	12	22.4	22.6	23.0	23.2	22.8
	13	22.6	22.8	22.9	22.8	22.8
	14	22.1	22.4	22.6	22.6	22.4
	15	22.0	22.2	22.4	22.8	22.4
	16	22.3	22.3	22.2	22.5	22.3
	17	22.1	22.3	22.7	22.9	22.5
	18	22.5	22.6	22.7	22.6	22.6
	Total average					22.7

Table H22 : Measurements of globe temperature at Office B – Level 21.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 21	1	23.5	23.8	23.6	23.8	23.7
	2	23.7	23.6	24.0	24.0	23.8
	3	23.8	23.8	23.3	23.6	23.6
	4	23.4	23.4	23.8	24.2	23.7
	Total average					23.7

Table H23 : Measurements of air velocity at Office B – Level 8.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 8	1	0.11	0.13	0.11	0.06	0.10
	2	0.09	0.14	0.05	0.08	0.09
	3	0.08	0.05	0.06	0.05	0.06
	4	0.20	0.10	0.10	0.18	0.14
	5	0.10	0.21	0.23	0.10	0.16
	6	0.10	0.07	0.05	0.05	0.07
	7	0.07	0.12	0.07	0.08	0.08
	8	0.10	0.10	0.11	0.10	0.10
	9	0.12	0.13	0.15	0.13	0.13
	10	0.10	0.06	0.05	0.11	0.08
	Total average					0.10

Table H24 : Measurements of air velocity at Office B – Level 14.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 14	1	0.06	0.06	0.06	0.06	0.06
	2	0.14	0.15	0.17	0.15	0.15
	3	0.07	0.04	0.04	0.08	0.06
	4	0.06	0.06	0.06	0.03	0.05
	5	0.06	0.09	0.03	0.05	0.06
	6	0.10	0.07	0.09	0.06	0.08
	7	0.13	0.06	0.06	0.11	0.09
	8	0.06	0.12	0.13	0.06	0.09
	9	0.10	0.07	0.05	0.05	0.07
	10	0.14	0.07	0.07	0.13	0.10
	11	0.09	0.18	0.20	0.09	0.14
	Total average					0.09

Table H25 : Measurements of air velocity at Office B – Level 17.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 17	1	0.09	0.14	0.05	0.08	0.09
	2	0.14	0.10	0.12	0.09	0.11
	3	0.11	0.06	0.06	0.10	0.08
	4	0.06	0.13	0.14	0.06	0.10
	5	0.14	0.10	0.07	0.07	0.10
	6	0.10	0.16	0.10	0.13	0.12
	7	0.04	0.04	0.04	0.04	0.04
	8	0.07	0.08	0.09	0.08	0.08

	9	0.11	0.07	0.06	0.12	0.09
	10	0.08	0.09	0.08	0.04	0.07
	11	0.06	0.09	0.03	0.05	0.06
	12	0.13	0.09	0.11	0.08	0.10
	13	0.11	0.06	0.06	0.10	0.08
	14	0.05	0.10	0.11	0.05	0.08
	15	0.14	0.11	0.07	0.06	0.10
	16	0.02	0.03	0.02	0.02	0.02
	17	0.10	0.11	0.10	0.05	0.09
	18	0.06	0.09	0.03	0.05	0.06
	Total average					0.08

Table H26 : Measurements of air velocity at Office B – Level 21.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 21	1	0.07	0.04	0.04	0.08	0.06
	2	0.07	0.08	0.07	0.03	0.06
	3	0.07	0.11	0.04	0.06	0.07
	4	0.09	0.06	0.08	0.06	0.07
	Total average					0.07

Table H27 : Measurements of relative humidity at Office B – Level 8.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 8	1	52.0	52.2	52.1	52.5	52.2
	2	52.3	52.7	52.5	52.5	52.5
	3	52.3	52.2	52.9	52.7	52.5
	4	52.3	52.1	52.1	52.4	52.2
	5	51.9	51.6	51.1	51.0	51.4
	6	51.2	51.0	51.2	51.0	51.1
	7	51.2	50.7	50.5	50.9	50.8
	8	50.9	51.1	50.8	51.6	51.1
	9	52.0	53.0	53.4	53.5	53.0
	10	54.1	53.8	53.3	53.1	53.6
	Total average					52.0

Table H28 : Measurements of relative humidity at Office B – Level 14.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 14	1	53.6	53.6	54.3	54.1	53.9
	2	53.2	53.0	53.0	53.3	53.1
	3	53.5	53.2	52.7	52.6	53.0
	4	53.3	53.1	53.3	53.0	53.2
	5	53.7	53.2	52.9	53.4	53.3
	6	53.0	53.2	52.8	53.7	53.2
	7	52.1	53.1	53.5	53.6	53.1
	8	52.0	52.7	52.8	54.9	53.1
	9	53.1	53.3	53.2	53.6	53.3
	10	53.2	53.6	53.4	53.4	53.4
	11	53.3	53.3	54.0	53.8	53.6
	Total average					53.3

Table H29 : Measurements of relative humidity at Office B – Level 17.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 17	1	57.9	57.8	58.7	58.4	58.2
	2	58.3	58.1	58.1	58.4	58.2
	3	58.5	58.2	57.7	57.5	58.0
	4	59.6	59.4	59.6	59.3	59.5
	5	60.0	59.4	59.1	59.6	59.5
	6	61.3	61.5	61.1	62.1	61.5
	7	61.9	63.0	63.5	63.6	63.0
	8	62.0	62.8	63.0	65.5	63.3
	9	64.3	64.6	64.5	64.9	64.6
	10	64.2	64.7	64.5	64.5	64.5
	11	63.1	63.0	63.9	63.6	63.4
	12	62.7	62.5	62.5	62.8	62.6
	13	62.9	62.6	62.0	61.8	62.3
	14	62.4	62.2	62.4	62.1	62.3
	15	64.0	63.4	63.1	63.6	63.5
	16	64.2	64.4	64.0	65.0	64.4
	17	63.0	64.2	64.7	64.8	64.2
	18	64.8	64.5	63.9	63.7	64.2
	Total average					62.1

Table H30 : Measurements of relative humidity at Office B – Level 21.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B - Level 21	1	59.5	59.3	59.3	59.6	59.4
	2	60.4	60.2	59.6	59.4	59.9
	3	60.5	60.3	60.5	60.2	60.4
	4	61.5	60.9	60.6	61.1	61.0
	Total average					60.2

Table H31 : Measurements of metabolic rate at Office B – Level 8.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Level 8	Seated quiet	1.0	7	7.0	
	Typing	1.1	11	12.1	
	Standing relaxed	1.2	4	4.8	
	Filing (standing)	1.4	3	4.2	
	Walking about	1.7	0	0.0	
	Total		25	28.1	1.12

Table H32 : Measurements of metabolic rate at Office B – Level 14.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Level 14	Seated quiet	1.0	5	5.0	
	Typing	1.1	5	5.5	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		11	11.7	1.06

Table H33 : Measurements of metabolic rate at Office B – Level 17.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Level 17	Seated quiet	1.0	5	5.0	
	Typing	1.1	16	17.6	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		23	25.0	1.09

Table H34 : Measurements of metabolic rate at Office B – Level 21.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Level 21	Seated quiet	1.0	4	4.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	1	1.7	
	Total		6	6.8	1.13

Table H35 : Measurements of clothing value at Office B – Level 8.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Level 8	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	21	5.25	
	Normal trousers	0.15	25	3.75	
	Socks	0.02	25	0.50	
	Shoes	0.02	25	0.50	
	Jacket	0.36	0	0.00	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	0	0.00	
	Total		25	10.76	0.43

Table H36 : Measurements of clothing value at Office B – Level 14.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Level 14	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	11	2.75	
	Normal trousers	0.15	11	1.65	
	Socks	0.02	11	0.22	
	Shoes	0.02	11	0.22	
	Jacket	0.36	2	0.72	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	0	0.00	
	Total		11	5.56	0.51

Table H37 : Measurements of clothing value at Office B – Level 17.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Level 17	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	18	4.50	
	Normal trousers	0.15	23	3.45	
	Socks	0.02	23	0.46	
	Shoes	0.02	23	0.46	
	Jacket	0.36	8	2.88	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	0	0.00	
	Total		23	12.70	0.55

Table H38 : Measurements of clothing value at Office B – Level 21.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Level 21	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	3	0.75	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	5	0.10	
	Shoes	0.02	6	0.12	
	Jacket	0.36	0	0.00	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	1	0.14	
	Total		6	2.43	0.41

Table H39 : Measurements of AMV at Office B – Level 8.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Level 8	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	12	0.0	
	Slightly cool	-1	8	-8.0	
	Cool	-2	2	-4.0	
	Cold	-3	2	-6.0	
	Total		25	-17.0	-0.68

Table H40 : Measurements of AMV at Office B – Level 14.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Level 14	Hot	3	0	0.0	
	Warm	2	1	2.0	
	Slightly warm	1	1	1.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	4	-8.0	
	Cold	-3	1	-3.0	
	Total		11	-10.0	-0.91

Table H41 : Measurements of AMV at Office B – Level 17.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Level 17	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	14	0.0	
	Slightly cool	-1	5	-5.0	
	Cool	-2	4	-8.0	
	Cold	-3	0	0.0	
	Total		23	-13.0	-0.57

Table H42 : Measurements of AMV at Office B – Level 21.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Level 21	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	3	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		6	-1.0	-0.17

Table H43 : Measurements of air temperature at Office C – Ground Floor.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C - Ground Floor	1	23.5	23.4	23.4	23.4	23.4
	2	23.6	23.7	23.8	23.9	23.8
	3	24.0	24.0	24.1	24.0	24.0
	4	24.0	24.0	24.1	24.0	24.0
	5	23.9	23.8	23.9	24.0	23.9
	6	23.0	23.0	23.0	23.0	23.0
	7	23.3	23.2	23.2	23.2	23.2
	8	23.6	23.6	23.7	23.7	23.7
	9	26.0	26.3	26.1	26.1	26.1
	10	26.0	26.0	26.1	26.1	26.1
	11	25.1	25.1	25.1	25.1	25.1
	12	25.0	25.1	25.0	25.0	25.0
	13	24.8	24.7	24.7	24.8	24.8
	14	25.0	25.0	25.1	25.1	25.1
	15	25.2	25.4	25.4	25.4	25.4
	Total average					24.4

Table H44 : Measurements of air temperature at Office C – Level 1.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C - Level 1	1	23.8	23.7	23.5	23.5	23.6
	2	23.1	23.1	23.3	23.4	23.2
	3	23.7	23.7	23.8	23.8	23.8
	4	23.6	23.5	23.6	23.5	23.6
	5	23.1	23.1	23.1	23.1	23.1
	6	22.8	23.0	23.0	23.0	23.0
	7	23.0	22.9	22.9	22.9	22.9
	8	22.9	23.2	23.2	23.4	23.2
	9	22.6	22.7	22.7	22.9	22.7
	10	22.9	23.1	23.0	23.1	23.0
	11	23.5	23.5	23.6	23.6	23.6
	12	23.3	23.3	23.3	23.4	23.3
	13	23.2	23.3	23.3	23.2	23.3
	14	22.8	22.9	23.0	23.1	23.0
	15	23.2	23.1	23.3	23.4	23.3
	16	22.9	23.0	22.9	22.9	22.9
	Total average					23.2

Table H45 : Measurements of globe temperature at Office C – Ground Floor.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C - Ground Floor	1	26.3	26.5	26.2	26.2	26.3
	2	25.3	25.8	26.2	26.2	25.9
	3	25.7	25.9	25.8	25.9	25.8
	4	25.5	25.7	26.0	26.0	25.8
	5	25.6	25.7	25.9	26.1	25.8
	6	25.5	25.9	26.0	26.0	25.8
	7	25.7	25.9	25.6	25.6	25.7
	8	25.1	25.6	26.1	26.1	25.7
	9	25.5	25.7	25.6	25.7	25.6
	10	25.4	25.6	25.9	25.9	25.7
	11	25.5	25.6	25.8	26.0	25.7
	12	25.4	25.8	25.9	25.9	25.7
	13	25.6	25.7	25.8	25.8	25.7
	14	25.3	25.5	25.8	25.7	25.6
	15	25.4	25.5	25.7	25.9	25.6
	Total average					25.8

Table H46 : Measurements of globe temperature at Office C – Level 1.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C - Level 1	1	27.8	26.9	27.3	27.3	27.3
	2	26.7	27.1	26.9	27.1	27.0
	3	26.3	26.1	26.7	26.7	26.4
	4	26.4	26.4	25.9	26.3	26.2
	5	25.6	25.6	26.1	26.5	26.0
	6	25.5	25.5	26.0	26.4	25.8
	7	26.2	25.3	25.7	25.7	25.7
	8	25.2	25.6	25.4	25.6	25.5
	9	24.9	24.7	25.3	25.3	25.0
	10	25.1	25.1	24.6	25.0	24.9
	11	24.6	24.6	25.1	25.5	25.0
	12	24.7	24.7	25.2	25.5	25.0
	13	24.6	25.0	24.8	25.0	24.9
	14	24.8	24.6	25.2	25.2	24.9
	15	25.1	25.1	24.6	25.0	24.9
	16	24.5	24.5	25.0	25.4	24.9
	Total average					25.6

Table H47 : Measurements of air velocity at Office C – Ground Floor.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C - Ground Floor	1	0.05	0.05	0.06	0.05	0.05
	2	0.09	0.05	0.04	0.10	0.07
	3	0.13	0.14	0.13	0.06	0.11
	4	0.09	0.14	0.05	0.08	0.09
	5	0.11	0.08	0.10	0.07	0.09
	6	0.17	0.09	0.09	0.15	0.12
	7	0.06	0.13	0.14	0.06	0.10
	8	0.07	0.05	0.03	0.03	0.05
	9	0.05	0.09	0.05	0.06	0.06
	10	0.09	0.05	0.04	0.10	0.07
	11	0.13	0.14	0.13	0.06	0.11
	12	0.09	0.14	0.05	0.08	0.09
	13	0.11	0.08	0.10	0.07	0.09
	14	0.13	0.06	0.06	0.11	0.09
	15	0.06	0.12	0.13	0.06	0.09
	Total average					0.09

Table H48 : Measurements of air velocity at Office C – Level 1.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C - Level 1	1	0.10	0.11	0.10	0.05	0.09
	2	0.13	0.19	0.06	0.10	0.12
	3	0.09	0.06	0.08	0.06	0.07
	4	0.13	0.06	0.06	0.11	0.09
	5	0.03	0.05	0.06	0.03	0.04
	6	0.06	0.04	0.02	0.02	0.04
	7	0.06	0.10	0.06	0.07	0.07
	8	0.09	0.10	0.12	0.10	0.10
	9	0.02	0.01	0.01	0.03	0.02
	10	0.08	0.09	0.08	0.04	0.07
	11	0.12	0.17	0.06	0.09	0.11
	12	0.13	0.09	0.11	0.08	0.10
	13	0.19	0.09	0.09	0.16	0.13
	14	0.08	0.17	0.18	0.08	0.13
	15	0.15	0.11	0.09	0.07	0.11
	16	0.08	0.15	0.08	0.10	0.10
	Total average					0.09

Table H49 : Measurements of relative humidity at Office C – Ground Floor.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C	1	43.7	43.5	43.1	42.9	43.3
- Ground Floor	2	47.9	47.7	47.9	47.7	47.8
	3	48.4	47.9	47.7	48.1	48.0
	4	48.0	48.2	47.9	48.6	48.2
	5	47.4	48.3	48.7	48.8	48.3
	6	47.5	48.1	48.3	50.2	48.5
	7	48.5	48.7	48.6	49.0	48.7
	8	48.8	49.2	49.0	49.0	49.0
	9	49.3	49.2	49.9	49.7	49.5
	10	49.8	49.6	49.6	49.9	49.7
	11	50.5	50.2	49.7	49.6	50.0
	12	50.3	50.1	50.3	50.1	50.2
	13	50.8	50.3	50.1	50.5	50.4
	14	50.4	50.6	50.3	51.1	50.6
	15	50.0	50.9	51.3	51.4	50.9
	Total average					48.9

Table H50 : Measurements of relative humidity at Office C – Level 1.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C	1	41.4	41.8	41.6	41.6	41.6
- Level 1	2	42.2	42.1	42.8	42.5	42.4
	3	43.3	43.1	43.1	43.4	43.2
	4	43.4	43.2	42.8	42.6	43.0
	5	42.0	41.8	42.0	41.8	41.9
	6	43.6	43.2	43.0	43.4	43.3
	7	42.0	42.1	41.8	42.5	42.1
	8	42.0	42.8	43.2	43.2	42.8
	9	42.4	42.8	42.6	42.6	42.6
	10	41.6	41.5	42.1	41.9	41.8
	11	43.9	43.7	43.7	44.0	43.8
	12	49.1	48.9	48.4	48.3	48.7
	13	49.7	49.5	49.7	49.5	49.6
	14	47.4	46.9	46.7	47.1	47.0
	15	46.7	46.9	46.6	47.3	46.9
	16	45.9	46.7	47.1	47.2	46.7
	Total average					44.2

Table H51 : Measurements of metabolic rate at Office C – Ground Floor.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C	Seated quiet	1.0	2	2.0	
- Ground Floor	Typing	1.1	28	30.8	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		33	36.6	1.11

Table H52 : Measurements of metabolic rate at Office C – Level 1.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C	Seated quiet	1.0	0	0.0	
- Level 1	Typing	1.1	28	30.8	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	3	5.1	
	Total		33	38.5	1.17

Table H53 : Measurements of clothing value at Office C – Ground Floor.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C	Short-sleeve	0.19	1	0.19	
- Ground Floor	Normal long-sleeve shirt	0.25	32	8.00	
	Normal trousers	0.15	33	4.95	
	Socks	0.02	33	0.66	
	Shoes	0.02	33	0.66	
	Jacket	0.36	33	11.88	
	Total		33	26.34	0.80

Table H54 : Measurements of clothing value at Office C – Level 1.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C	Short-sleeve	0.19	8	1.52	
- Level 1	Normal long-sleeve shirt	0.25	25	6.25	
	Normal trousers	0.15	31	4.65	
	Socks	0.02	31	0.62	
	Shoes	0.02	33	0.66	
	Jacket	0.36	27	9.72	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	2	0.28	
	Total		33	23.70	0.72

Table H55 : Measurements of AMV at Office C – Ground Floor.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Ground Floor	Hot	3	2	6.0	
	Warm	2	2	4.0	
	Slightly warm	1	13	13.0	
	Neutral	0	10	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		33	15.0	0.45

Table H56 : Measurements of AMV at Office C – Level 1.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Level 1	Hot	3	0	0.0	
	Warm	2	1	2.0	
	Slightly warm	1	10	10.0	
	Neutral	0	20	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		33	10.0	0.30

Table H57 : Measurements of air temperature at Office D – Level 2.

Office - Level / Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 2	1	25.1	24.9	25.0	24.8	24.9
	2	24.7	24.8	24.8	24.3	24.6
	3	24.0	24.0	24.1	24.0	24.0
	4	23.3	23.4	23.4	23.2	23.3
	5	24.2	24.3	24.2	24.0	24.2
	6	24.1	24.1	24.2	24.2	24.2
	7	24.1	24.1	24.2	24.2	24.2
	8	24.2	24.2	24.2	24.2	24.2
	Total average					24.2

Table H58 : Measurements of air temperature at Office D – Level 4.

Office - Level / Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 4	1	25.1	24.9	25.0	24.8	24.9
	2	24.7	24.8	24.8	24.8	24.8
	3	24.7	24.8	24.8	24.8	24.8
	4	24.2	24.3	24.2	24.0	24.2
	5	24.0	24.0	24.1	23.5	23.9
	6	23.4	23.4	23.4	23.2	23.4
	7	23.1	23.1	23.1	23.2	23.1
	8	23.3	23.4	23.4	23.3	23.4
	9	23.1	23.1	23.2	23.1	23.1
	10	23.3	23.4	23.6	23.4	23.4
	Total average					23.9

Table H59 : Measurements of globe temperature at Office D – Level 2.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 2	1	25.4	24.5	24.9	24.9	24.9
	2	24.4	24.8	24.5	24.8	24.6
	3	23.9	23.8	24.2	24.3	24.0
	4	23.5	23.5	23.0	23.5	23.3
	5	23.8	23.8	24.3	24.7	24.2
	6	23.9	23.9	24.4	24.7	24.2
	7	24.4	24.2	23.9	24.4	24.2
	8	23.9	23.9	24.4	24.7	24.2
	Total average					24.2

Table H60 : Measurements of globe temperature at Office D – Level 4.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 4	1	24.8	24.7	25.0	25.2	24.9
	2	25.0	25.0	24.5	25.0	24.8
	3	24.4	24.4	25.0	25.2	24.8
	4	23.9	23.9	24.4	24.7	24.2
	5	24.3	23.5	23.9	23.9	23.9
	6	23.1	23.5	23.3	23.5	23.4
	7	23.0	22.9	23.4	23.4	23.1
	8	23.5	23.5	23.1	23.5	23.4
	9	22.8	22.8	23.3	23.6	23.1
	10	23.1	23.1	23.6	23.9	23.4
	Total average					23.9

Table H61 : Measurements of air velocity at Office D – Level 2.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 2	1	0.03	0.03	0.03	0.03	0.03
	2	0.02	0.04	0.02	0.04	0.03
	3	0.02	0.01	0.04	0.09	0.04
	4	0.03	0.03	0.04	0.05	0.04
	5	0.04	0.05	0.05	0.05	0.05
	6	0.01	0.03	0.10	0.10	0.06
	7	0.02	0.05	0.03	0.09	0.05
	8	0.03	0.03	0.02	0.03	0.03
	Total average					0.04

Table H62 : Measurements of air velocity at Office D – Level 4.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 4	1	0.02	0.01	0.03	0.01	0.02
	2	0.03	0.03	0.03	0.04	0.03
	3	0.02	0.01	0.04	0.02	0.02
	4	0.02	0.02	0.03	0.02	0.02
	5	0.04	0.04	0.04	0.05	0.04
	6	0.03	0.04	0.03	0.03	0.03
	7	0.03	0.04	0.02	0.03	0.03
	8	0.04	0.04	0.05	0.04	0.04
	9	0.03	0.02	0.01	0.04	0.02
	10	0.02	0.04	0.04	0.04	0.04
	Total average					0.03

Table H63 : Measurements of relative humidity at Office D – Level 2.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 2	1	51.2	51.5	53.2	51.7	51.9
	2	52.7	52.8	52.8	52.7	52.8
	3	53.7	54.5	54.2	52.8	53.8
	4	53.0	53.4	53.2	53.5	53.3
	5	52.3	53.3	53.2	52.1	52.7
	6	52.2	53.8	53.0	52.7	52.9
	7	52.7	53.1	53.2	52.7	52.9
	8	53.0	53.5	53.6	53.2	53.3
	Total average					53.0

Table H64 : Measurements of relative humidity at Office D – Level 4.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D - Level 4	1	50.6	51.0	51.8	50.7	51.0
	2	51.7	52.2	52.0	52.6	52.1
	3	53.3	53.3	53.6	53.1	53.3
	4	52.5	53.8	53.0	52.7	53.0
	5	52.4	53.4	54.3	53.5	53.4
	6	53.3	53.5	53.6	53.7	53.5
	7	54.0	54.5	54.2	53.9	54.2
	8	53.0	53.1	53.2	52.9	53.1
	9	52.6	52.8	52.8	52.8	52.8
	10	52.2	52.4	52.7	52.1	52.4
	Total average					52.9

Table H65 : Measurements of metabolic rate at Office D – Level 2.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Level 2	Seated quiet	1.0	0	0.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	2	2.8	
	Walking about	1.7	2	3.4	
	Total		6	8.5	1.42

Table H66 : Measurements of metabolic rate at Office D – Level 4.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Level 4	Seated quiet	1.0	0	0.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	8	9.6	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		10	12.1	1.21

Table H67 : Measurements of clothing value at Office D – Level 2.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Level 2	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	6	1.50	
	Normal trousers	0.15	6	0.90	
	Socks	0.02	3	0.06	
	Shoes	0.02	6	0.12	
	Jacket	0.36	0	0.00	
	Total		6	2.58	0.43

Table H68 : Measurements of clothing value at Office D – Level 4.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Level 4	Short-sleeve	0.19	0	0.00	
	Normal long-sleeve shirt	0.25	10	2.50	
	Normal trousers	0.15	9	1.35	
	Socks	0.02	2	0.04	
	Shoes	0.02	10	0.20	
	Jacket	0.36	5	1.80	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	1	0.14	
	Total		10	6.03	0.60

Table H69 : Measurements of AMV at Office D – Level 2.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Level 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	4	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		6	-1.0	-0.17

Table H70 : Measurements of AMV at Office D – Level 4.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Level 4	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	2	2.0	
	Neutral	0	5	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		10	-2.0	-0.20

Table H71 : Measurements of air temperature at Office E – HR Department.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Human Resource Department	1	23.6	23.3	23.2	23.2	23.3
	2	23.1	23.2	22.9	22.7	23.0
	3	22.9	22.6	22.5	22.7	22.7
	4	22.7	22.8	22.8	22.9	22.8
	5	23.0	22.9	22.9	22.9	22.9
	Total average					22.9

Table H72 : Measurements of air temperature at Office E – Corporate Department.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Corporate Department	1	22.8	22.8	22.8	22.8	22.8
	2	22.6	22.5	22.6	22.6	22.6
	3	22.8	22.9	22.9	22.9	22.9
	4	22.4	22.5	22.3	22.1	22.3
	5	22.5	22.7	22.8	22.7	22.7
	Total average					22.7

Table H73 : Measurements of globe temperature at Office E – HR Department.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Human Resource Department	1	24.3	24.6	24.4	24.6	24.5
	2	24.2	24.1	24.5	24.5	24.3
	3	24.4	24.4	23.9	24.2	24.2
	4	23.6	23.6	24.0	24.4	23.9
	5	23.5	23.5	24.0	24.3	23.8
	Total average					24.1

Table H74 : Measurements of globe temperature at Office E – Corporate Department.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Corporate Department	1	23.7	23.0	23.3	23.3	23.3
	2	23.2	23.5	23.3	23.5	23.4
	3	23.3	23.2	23.6	23.6	23.4
	4	23.6	23.5	23.1	23.6	23.4
	5	23.0	23.0	23.4	23.8	23.3
	Total average					23.4

Table H75 : Measurements of air velocity at Office E – HR Department.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Human Resource Department	1	0.03	0.06	0.07	0.03	0.05
	2	0.06	0.04	0.02	0.02	0.04
	3	0.03	0.06	0.03	0.04	0.04
	4	0.05	0.06	0.07	0.06	0.06
	5	0.07	0.04	0.04	0.08	0.06
	Total average					0.05

Table H76 : Measurements of air velocity at Office E – Corporate Department.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Corporate Department	1	0.04	0.02	0.02	0.04	0.03
	2	0.05	0.05	0.05	0.02	0.04
	3	0.03	0.05	0.02	0.03	0.03
	4	0.04	0.03	0.03	0.02	0.03
	5	0.06	0.03	0.03	0.05	0.04
	Total average					0.03

Table H77 : Measurements of relative humidity at Office E – HR Department.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Human Resource Department	1	60.8	60.6	60.0	59.8	60.3
	2	61.2	61.0	61.2	60.9	61.1
	3	62.5	61.9	61.6	62.1	62.0
	4	63.1	63.3	62.9	63.9	63.3
	5	61.7	62.8	63.3	63.4	62.8
	Total average					61.9

Table H78 : Measurements of relative humidity at Office E – Corporate Department.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E - Corporate Department	1	59.5	59.4	60.3	60.0	59.8
	2	58.2	58.0	58.0	58.3	58.1
	3	58.6	58.4	57.8	57.6	58.1
	4	64.4	64.2	64.4	64.1	64.3
	5	63.8	63.2	62.9	63.4	63.3
	Total average					60.7

Table H79 : Measurements of metabolic rate at Office E – HR Department.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Human Resource Department	Seated quiet	1.0	2	2.0	
	Typing	1.1	4	4.4	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	6	10.2	
	Total		12	16.6	1.38

Table H80 : Measurements of metabolic rate at Office E – Corporate Department.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Corporate Department	Seated quiet	1.0	1	1.0	
	Typing	1.1	12	13.2	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	3	5.1	
	Total		16	19.3	1.21

Table H81 : Measurements of clothing value at Office E – HR Department.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Human Resource Department	Short-sleeve	0.19	8	1.52	
	Normal long-sleeve shirt	0.25	4	1.00	
	Normal trousers	0.15	12	1.80	
	Socks	0.02	12	0.24	
	Shoes	0.02	12	0.24	
	Jacket	0.36	1	0.36	
	Total		12	5.16	0.43

Table H82 : Measurements of clothing value at Office E – Corporate Department.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Corporate Department	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	12	3.00	
	Normal trousers	0.15	16	2.40	
	Socks	0.02	16	0.32	
	Shoes	0.02	16	0.32	
	Jacket	0.36	4	1.44	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	0	0.00	
	Total		16	8.24	0.52

Table H83 : Measurements of AMV at Office E – HR Department.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Human Resource Department	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	7	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		12	-5.0	-0.42

Table H84 : Measurements of AMV at Office E – Corporate Department.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Corporate Department	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	3	3.0	
	Neutral	0	7	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	2	-4.0	
	Cold	-3	2	-6.0	
	Total		16	-9.0	-0.56

Table H85 : Measurements of air temperature at Office F – Level 1.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Level 1	1	22.1	21.8	21.7	21.7	21.8
	2	21.4	21.5	21.2	21.0	21.3
	3	20.8	20.5	20.4	20.6	20.6
	4	20.2	20.3	20.3	20.4	20.3
	5	20.3	20.2	20.2	20.2	20.2
	6	20.1	20.1	20.1	20.1	20.1
	7	19.9	19.8	19.9	19.9	19.9
	8	19.6	19.7	19.7	19.7	19.7
	9	19.5	19.6	19.4	19.2	19.4
	10	18.9	19.1	19.2	19.1	19.1
	Total average					20.2

Table H86 : Measurements of air temperature at Office F – Ground Floor.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Ground Floor	1	25.0	24.7	24.6	24.6	24.7
	2	23.1	23.2	22.9	22.7	23.0
	3	23.9	23.6	23.5	23.7	23.7
	4	23.2	23.3	23.3	23.4	23.3
	5	23.2	23.1	23.1	23.1	23.1
	6	23.1	23.1	23.1	23.1	23.1
	7	23.3	23.2	23.3	23.3	23.3
	8	23.3	23.4	23.4	23.4	23.4
	9	23.3	23.4	23.2	23.0	23.2
	10	23.1	23.3	23.4	23.3	23.3
	Total average					23.4

Table H87 : Measurements of globe temperature at Office F – Level 1.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Level 1	1	21.5	21.5	21.2	21.4	21.4
	2	21.2	21.2	21.5	21.6	21.4
	3	21.3	21.3	21.6	21.6	21.4
	4	21.6	21.2	21.4	21.4	21.4
	5	21.2	21.5	21.3	21.5	21.4
	6	21.3	21.3	21.5	21.4	21.4
	7	21.5	21.5	21.4	21.5	21.5
	8	21.4	21.4	21.6	21.6	21.5
	9	21.4	21.5	21.5	21.6	21.5
	10	21.4	21.5	21.4	21.4	21.4
	Total average					21.4

Table H88 : Measurements of globe temperature at Office F – Ground Floor.

Office - Level / Department	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Ground Floor	1	25.2	24.4	24.7	24.7	24.7
	2	22.7	23.1	22.9	23.1	23.0
	3	23.6	23.5	24.0	24.0	23.7
	4	23.5	23.5	23.0	23.4	23.3
	5	22.8	22.8	23.3	23.6	23.1
	6	22.8	22.8	23.3	23.6	23.1
	7	23.0	23.4	23.2	23.4	23.3
	8	23.3	23.2	23.6	23.6	23.4
	9	23.4	23.4	22.9	23.2	23.2
	10	23.0	23.0	23.4	23.8	23.3
	Total average					23.4

Table H89 : Measurements of air velocity at Office F – Level 1.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Level 1	1	0.06	0.06	0.06	0.06	0.06
	2	0.05	0.05	0.06	0.05	0.05
	3	0.14	0.08	0.07	0.15	0.11
	4	0.16	0.18	0.16	0.08	0.14
	5	0.08	0.13	0.04	0.07	0.08
	6	0.18	0.13	0.15	0.11	0.14
	7	0.13	0.06	0.06	0.11	0.09
	8	0.06	0.13	0.14	0.06	0.10
	9	0.07	0.05	0.03	0.03	0.05
	10	0.04	0.07	0.04	0.05	0.05
	Total average					0.09

Table H90 : Measurements of air velocity at Office F – Ground Floor.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Ground Floor	1	0.13	0.13	0.14	0.13	0.13
	2	0.11	0.12	0.14	0.12	0.12
	3	0.10	0.06	0.05	0.11	0.08
	4	0.10	0.11	0.10	0.05	0.09
	5	0.10	0.15	0.05	0.08	0.10
	6	0.14	0.10	0.12	0.09	0.11
	7	0.08	0.04	0.04	0.07	0.06
	8	0.05	0.10	0.11	0.05	0.08
	9	0.07	0.05	0.03	0.03	0.05
	10	0.04	0.07	0.04	0.05	0.05
	Total average					0.09

Table H91 : Measurements of relative humidity at Office F – Level 1.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Level 1	1	52.1	52.8	52.9	55.0	53.2
	2	52.4	52.6	52.5	52.9	52.6
	3	54.3	54.8	54.6	54.6	54.6
	4	55.4	55.3	56.2	55.9	55.7
	5	55.5	55.3	55.3	55.6	55.4
	6	56.8	56.5	56.0	55.8	56.3
	7	57.5	57.3	57.5	57.2	57.4
	8	56.5	56.0	55.7	56.2	56.1
	9	58.2	58.4	58.0	58.9	58.4
	10	56.9	57.9	58.4	58.5	57.9
	Total average					55.8

Table H92 : Measurements of relative humidity at Office F – Ground Floor.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F - Ground Floor	1	57.4	58.1	58.3	60.6	58.6
	2	61.1	61.4	61.3	61.7	61.4
	3	60.0	60.5	60.3	60.3	60.3
	4	61.2	61.1	62.0	61.7	61.5
	5	62.8	62.5	62.5	62.9	62.7
	6	63.3	63.0	62.4	62.2	62.7
	7	62.8	62.6	62.8	62.5	62.7
	8	62.9	62.3	62.0	62.5	62.4
	9	62.5	62.7	62.3	63.3	62.7
	10	63.6	64.8	65.3	65.4	64.8
	Total average					62.0

Table H93 : Measurements of metabolic rate at Office F – Level 1.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Level 1	Seated quiet	1.0	2	2.0	
	Typing	1.1	7	7.7	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	6	10.2	
	Total		17	22.3	1.31

Table H94 : Measurements of metabolic rate at Office F – Ground Floor.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Ground Floor	Seated quiet	1.0	15	15.0	
	Typing	1.1	2	2.2	
	Standing relaxed	1.2	4	4.8	
	Filing (standing)	1.4	8	11.2	
	Walking about	1.7	7	11.9	
	Total		36	45.1	1.25

Table H95 : Measurements of clothing value at Office F – Level 1.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Level 1	Short-sleeve	0.19	14	2.66	
	Normal long-sleeve shirt	0.25	3	0.75	
	Normal trousers	0.15	17	2.55	
	Socks	0.02	1	0.02	
	Shoes	0.02	0	0.00	
	Jacket	0.36	9	3.24	
	Total		17	9.22	0.54

Table H96 : Measurements of clothing value at Office F – Ground Floor.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Ground Floor	Short-sleeve	0.19	24	4.56	
	Normal long-sleeve shirt	0.25	12	3.00	
	Normal trousers	0.15	34	5.10	
	Socks	0.02	23	0.46	
	Shoes	0.02	36	0.72	
	Jacket	0.36	11	3.96	
	Full slip	0.16	1	0.16	
	Skirt thin	0.14	2	0.28	
	Total		36	18.24	0.51

Table H97 : Measurements of AMV at Office F – Level 1.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Level 1	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	7	-14.0	
	Cold	-3	4	-12.0	
	Total		17	-29.0	-1.71

Table H98 : Measurements of AMV at Office F – Ground Floor.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Ground Floor	Hot	3	0	0.0	
	Warm	2	1	2.0	
	Slightly warm	1	4	4.0	
	Neutral	0	9	0.0	
	Slightly cool	-1	13	-13.0	
	Cool	-2	5	-10.0	
	Cold	-3	4	-12.0	
	Total		36	-29.0	-0.81

Table H99 : Measurements of air temperature at Office G – Level 19, Tower 1.

Office - Level / Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 19 Tower 1	1	24.3	24.0	23.9	24.1	24.1
	2	23.6	23.7	23.7	23.8	23.7
	3	24.3	24.2	24.2	24.2	24.2
	4	24.2	24.2	24.2	24.2	24.2
	5	24.2	24.1	24.2	24.2	24.2
	6	23.8	23.9	23.9	23.9	23.9
	7	24.0	24.1	23.9	23.7	23.9
	8	22.8	23.0	23.1	23.0	23.0
	Total average					23.9

Table H100 : Measurements of air temperature at Office G – Level 20, Tower 1.

Office - Level / Department	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 20 Tower 1	1	24.7	24.4	24.3	24.3	24.4
	2	23.5	23.6	23.3	23.1	23.4
	3	23.6	23.3	23.2	23.4	23.4
	4	23.3	23.4	23.4	23.5	23.4
	5	23.2	23.1	23.1	23.1	23.1
	6	23.0	23.0	23.0	23.0	23.0
	7	22.5	22.4	22.5	22.5	22.5
	8	22.5	22.6	22.6	22.6	22.6
	9	22.7	22.8	22.6	22.4	22.6
	10	22.5	22.7	22.8	22.7	22.7
	Total average					23.1

Table H101 : Measurements of air temperature at Office G – Level 10, Tower 2.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G	1	23.1	22.8	22.7	22.9	22.9
- Level 10	2	23.1	23.2	23.2	23.3	23.2
Tower 2	3	23.7	23.6	23.6	23.6	23.6
	Total average					23.2

Table H102 : Measurements of air temperature at Office G – Level 15, Tower 2.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G	1	23.5	23.2	23.1	23.1	23.2
- Level 15	2	23.2	23.3	23.0	22.8	23.1
Tower 2	3	23.5	23.2	23.1	23.3	23.3
	4	23.2	23.3	23.3	23.4	23.3
	5	22.9	22.8	22.8	22.8	22.8
	6	23.2	23.2	23.2	23.2	23.2
	7	23.4	23.3	23.4	23.4	23.4
	8	23.4	23.5	23.5	23.5	23.5
	9	23.9	24.0	23.8	23.6	23.8
	10	23.5	23.7	23.8	23.7	23.7
	Total average					23.3

Table H103 : Measurements of air temperature at Office G – Level 26, Tower 2.

Office - Level / Department	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G	1	20.2	20.1	20.1	20.1	20.1
- Level 26	2	21.3	21.3	21.3	21.3	21.3
Tower 2	3	20.7	20.6	20.7	20.7	20.7
	4	21.0	21.1	21.1	21.1	21.1
	5	21.5	21.6	21.4	21.2	21.4
	6	21.8	21.5	21.4	21.4	21.5
	7	21.1	21.2	20.9	20.7	21.0
	8	21.7	21.4	21.3	21.5	21.5
	9	21.1	21.2	21.2	21.3	21.2
	10	22.0	21.9	21.9	21.9	21.9
	Total average					21.2

Table H104 : Measurements of globe temperature at Office G – Level 19, Tower 1.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 19 Tower 1	1	24.2	23.9	24.0	24.0	24.0
	2	23.9	24.0	23.8	24.0	23.9
	3	23.8	23.9	24.0	24.0	23.9
	4	24.0	23.9	23.8	24.0	23.9
	5	23.9	23.9	24.1	24.1	24.0
	6	23.8	23.8	24.1	24.0	23.9
	7	23.9	24.0	24.0	24.0	24.0
	8	24.0	24.0	23.9	24.0	24.0
	Total average					24.0

Table H105 : Measurements of globe temperature at Office G – Level 20, Tower 1.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 20 Tower 1	1	24.9	24.0	24.4	24.4	24.4
	2	23.5	23.8	23.6	23.8	23.7
	3	23.5	23.4	23.8	23.8	23.6
	4	23.7	23.7	23.2	23.7	23.5
	5	23.3	23.3	23.7	24.1	23.6
	6	23.2	23.2	23.7	24.0	23.5
	7	23.3	23.6	23.4	23.6	23.5
	8	23.4	23.3	23.7	23.7	23.5
	9	23.6	23.6	23.1	23.4	23.4
	10	23.1	23.1	23.5	23.9	23.4
	Total average					23.6

Table H106 : Measurements of globe temperature at Office G – Level 10, Tower 2.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 10 Tower 2	1	23.5	23.8	23.6	23.8	23.7
	2	23.6	23.5	23.9	23.9	23.7
	3	23.9	23.9	23.4	23.7	23.7
	Total average					23.7

Table H107 : Measurements of globe temperature at Office G – Level 15, Tower 2.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 15 Tower 2	1	22.9	23.1	22.8	22.8	22.9
	2	22.4	22.7	23.0	23.0	22.8
	3	22.9	23.0	22.9	22.9	22.9
	4	22.8	23.0	23.1	23.1	23.0
	5	22.8	22.9	23.1	23.3	23.0
	6	22.9	23.1	23.2	23.1	23.1
	7	23.1	23.2	23.1	23.1	23.1
	8	22.9	23.1	23.3	23.3	23.1
	9	23.0	23.1	23.3	23.5	23.2
	10	23.1	23.3	23.3	23.3	23.3
	Total average					23.0

Table H108 : Measurements of globe temperature at Office G – Level 26, Tower 2.

Office - Level / Department	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 26 Tower 2	1	21.5	21.5	21.4	21.4	21.5
	2	21.5	21.4	21.5	21.5	21.5
	3	21.5	21.6	21.5	21.5	21.5
	4	21.4	21.5	21.5	21.5	21.5
	5	21.4	21.4	21.5	21.5	21.5
	6	21.4	21.5	21.6	21.5	21.5
	7	21.5	21.4	21.5	21.6	21.5
	8	21.4	21.5	21.4	21.4	21.4
	9	21.4	21.5	21.5	21.5	21.5
	10	21.4	21.4	21.5	21.5	21.5
	Total average					21.5

Table H109 : Measurements of air velocity at Office G – Level 19, Tower 1.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 19 Tower 1	1	0.23	0.11	0.11	0.20	0.16
	2	0.12	0.23	0.25	0.12	0.18
	3	0.17	0.13	0.09	0.08	0.12
	4	0.10	0.16	0.10	0.13	0.12
	5	0.09	0.09	0.10	0.09	0.09
	6	0.12	0.13	0.15	0.13	0.13
	7	0.25	0.15	0.12	0.27	0.20
	8	0.18	0.20	0.18	0.09	0.16
	Total average					0.15

Table H110 : Measurements of air velocity at Office G – Level 20, Tower 1.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 20 Tower 1	1	0.28	0.20	0.16	0.14	0.20
	2	0.22	0.35	0.22	0.27	0.26
	3	0.18	0.20	0.23	0.20	0.20
	4	0.12	0.07	0.06	0.14	0.10
	5	0.11	0.13	0.11	0.06	0.10
	6	0.11	0.16	0.05	0.08	0.10
	7	0.35	0.25	0.30	0.23	0.28
	8	0.27	0.14	0.14	0.25	0.20
	9	0.13	0.26	0.28	0.13	0.20
	10	0.28	0.20	0.15	0.15	0.20
	Total average					0.18

Table H111 : Measurements of air velocity at Office G – Level 10, Tower 2.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 10 Tower 2	1	0.05	0.10	0.11	0.05	0.08
	2	0.14	0.10	0.08	0.06	0.10
	3	0.07	0.12	0.07	0.08	0.08
	Total average					0.09

Table H112 : Measurements of air velocity at Office G – Level 15, Tower 2.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 15 Tower 2	1	0.06	0.06	0.06	0.06	0.06
	2	0.13	0.14	0.16	0.14	0.14
	3	0.07	0.04	0.04	0.08	0.06
	4	0.10	0.11	0.10	0.05	0.09
	5	0.14	0.21	0.07	0.11	0.13
	6	0.08	0.05	0.06	0.05	0.06
	7	0.11	0.06	0.06	0.10	0.08
	8	0.04	0.08	0.08	0.04	0.06
	9	0.08	0.06	0.05	0.04	0.06
	10	0.05	0.09	0.05	0.06	0.06
	Total average					0.08

Table H113 : Measurements of air velocity at Office G – Level 26, Tower 2.

Office - Level / Department	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 26 Tower 2	1	0.20	0.14	0.17	0.13	0.16
	2	0.17	0.09	0.09	0.15	0.12
	3	0.09	0.18	0.20	0.09	0.14
	4	0.14	0.10	0.08	0.06	0.10
	5	0.08	0.13	0.08	0.09	0.09
	6	0.07	0.04	0.04	0.08	0.06
	7	0.18	0.20	0.18	0.09	0.16
	8	0.11	0.16	0.05	0.08	0.10
	9	0.14	0.10	0.12	0.09	0.11
	10	0.09	0.04	0.04	0.08	0.06
	Total average					0.11

Table H114 : Measurements of relative humidity at Office G – Level 19, Tower 1.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 19 Tower 1	1	57.8	57.6	57.8	57.5	57.7
	2	58.2	57.7	57.4	57.9	57.8
	3	56.8	57.0	56.6	57.5	57.0
	4	56.7	57.7	58.2	58.3	57.7
	5	57.6	57.9	57.8	58.2	57.9
	6	57.5	58.0	57.8	57.8	57.8
	7	57.9	57.8	58.7	58.4	58.2
	8	58.7	58.5	58.5	58.8	58.6
	Total average					57.8

Table H115 : Measurements of relative humidity at Office G – Level 20, Tower 1.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 20 Tower 1	1	55.0	56.0	56.5	56.5	56.0
	2	59.4	59.9	59.7	59.7	59.7
	3	59.3	59.2	60.1	59.8	59.6
	4	59.1	58.9	58.9	59.2	59.0
	5	60.4	60.2	59.6	59.4	59.9
	6	60.5	60.3	60.5	60.2	60.4
	7	62.0	61.4	61.1	61.6	61.5
	8	61.2	61.4	61.0	62.0	61.4
	9	59.8	60.9	61.4	61.5	60.9
	10	59.9	60.6	60.8	63.2	61.1
	Total average					60.0

Table H116 : Measurements of relative humidity at Office G – Level 10, Tower 2.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 10 Tower 2	1	60.1	60.6	60.4	60.4	60.4
	2	59.3	59.2	60.1	59.8	59.6
	3	57.7	57.5	57.5	57.8	57.6
	Total average					59.2

Table H117 : Measurements of relative humidity at Office G – Level 15, Tower 2.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 15 Tower 2	1	59.7	59.1	58.8	59.3	59.2
	2	59.4	59.6	59.2	60.2	59.6
	3	58.3	59.4	59.9	60.0	59.4
	4	58.6	59.3	59.5	61.9	59.8
	5	60.4	60.7	60.6	61.0	60.7
	6	59.6	60.1	59.9	59.9	59.9
	7	58.6	58.5	59.4	59.1	58.9
	8	57.7	57.5	57.5	57.8	57.6
	9	58.2	57.9	57.4	57.2	57.7
	10	57.1	56.9	57.1	56.8	57.0
	Total average					59.0

Table H118 : Measurements of relative humidity at Office G – Level 26, Tower 2.

Office - Level / Department	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
G - Level 26 Tower 2	1	65.5	65.7	65.3	66.3	65.7
	2	61.1	62.2	62.7	62.8	62.2
	3	62.6	63.1	62.9	62.9	62.9
	4	62.0	61.9	62.8	62.5	62.3
	5	62.6	62.4	62.4	62.7	62.5
	6	62.0	61.7	61.1	60.9	61.4
	7	62.4	62.2	62.4	62.1	62.3
	8	61.9	61.3	61.0	61.5	61.4
	9	61.2	61.4	61.0	62.0	61.4
	10	59.3	60.4	60.9	61.1	60.4
	Total average					62.3

Table H119 : Measurements of metabolic rate at Office G – Level 19, Tower 1.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
G - Level 19 Tower 1	Seated quiet	1.0	0	0.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	11	18.7	
	Total		12	19.8	1.65

Table H120 : Measurements of metabolic rate at Office G – Level 20, Tower 1.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
G - Level 20 Tower 1	Seated quiet	1.0	3	3.0	
	Typing	1.1	13	14.3	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	4	6.8	
	Total		23	27.9	1.21

Table H121 : Measurements of metabolic rate at Office G – Level 10, Tower 2.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
G - Level 10 Tower 2	Seated quiet	1.0	0	0.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	3	5.1	
	Total		4	6.2	1.55

Table H122 : Measurements of metabolic rate at Office G – Level 15, Tower 2.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
G - Level 15 Tower 2	Seated quiet	1.0	11	11.0	
	Typing	1.1	5	5.5	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	1	1.7	
	Total		19	20.6	1.08

Table H123 : Measurements of metabolic rate at Office G – Level 26, Tower 2.

Office - Level / Department	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
G - Level 26 Tower 2	Seated quiet	1.0	0	0.0	
	Typing	1.1	9	9.9	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	3	5.1	
	Total		12	15.0	1.25

Table H124 : Measurements of clothing value at Office G – Level 19, Tower 1.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
G - Level 19 Tower 1	Short-sleeve	0.19	7	1.33	
	Normal long-sleeve shirt	0.25	5	1.25	
	Normal trousers	0.15	12	1.80	
	Socks	0.02	12	0.24	
	Shoes	0.02	12	0.24	
	Jacket	0.36	2	0.72	
	Total		12	5.58	0.47

Table H125 : Measurements of clothing value at Office G – Level 20, Tower 1.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
G - Level 20 Tower 1	Short-sleeve	0.19	6	1.14	
	Normal long-sleeve shirt	0.25	17	4.25	
	Normal trousers	0.15	23	3.45	
	Socks	0.02	23	0.46	
	Shoes	0.02	23	0.46	
	Jacket	0.36	6	2.16	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	0	0.00	
	Total		23	11.92	0.52

Table H126 : Measurements of clothing value at Office G – Level 10, Tower 2.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
G - Level 10 Tower 2	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	3	0.45	
	Socks	0.02	4	0.08	
	Shoes	0.02	4	0.08	
	Jacket	0.36	0	0.00	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	1	0.14	
	Total		4	1.57	0.39

Table H127 : Measurements of clothing value at Office G – Level 15, Tower 2.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
G - Level 15 Tower 2	Short-sleeve	0.19	9	1.71	
	Normal long-sleeve shirt	0.25	10	2.50	
	Normal trousers	0.15	16	2.40	
	Socks	0.02	16	0.32	
	Shoes	0.02	19	0.38	
	Jacket	0.36	3	1.08	
	Full slip	0.16	2	0.32	
	Skirt thin	0.14	3	0.42	
	Total		19	9.13	0.48

Table H128 : Measurements of clothing value at Office G – Level 26, Tower 2.

Office - Level / Department	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
G - Level 26 Tower 2	Short-sleeve	0.19	10	1.90	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	12	0.24	
	Shoes	0.02	12	0.24	
	Jacket	0.36	0	0.00	
	Full slip	0.16	0	0.00	
	Skirt thin	0.14	5	0.70	
	Total		12	4.63	0.39

Table H129 : Measurements of AMV at Office G – Level 19, Tower 1.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
G - Level 19 Tower 1	Hot	3	0	0.0	
	Warm	2	2	4.0	
	Slightly warm	1	6	6.0	
	Neutral	0	4	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		12	10.0	0.83

Table H130 : Measurements of AMV at Office G – Level 20, Tower 1.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
G - Level 20 Tower 1	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	2	2.0	
	Neutral	0	2	0.0	
	Slightly cool	-1	10	-10.0	
	Cool	-2	5	-10.0	
	Cold	-3	4	-12.0	
	Total		23	-30.0	-1.30

Table H131 : Measurements of AMV at Office G – Level 10, Tower 2.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
G - Level 10 Tower 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	3	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		4	1.0	0.25

Table H132 : Measurements of AMV at Office G – Level 15, Tower 2.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
G - Level 15 Tower 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	13	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		19	-6.0	-0.32

Table H133 : Measurements of AMV at Office G – Level 26, Tower 2.

Office - Level / Department	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
G - Level 26 Tower 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	5	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	2	-4.0	
	Cold	-3	3	-9.0	
	Total		12	-15.0	-1.25

Table H134 : Office A
(Outputs from ASHRAE Thermal Comfort Program)

Level / Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Level 1	-0.19	6	comfortable	in	24.6, too humid	23.7	-0.1	-0.1	9	48	0.4	21.9	23.8
Level 2	-0.13	5	comfortable	in	24.9, too humid	23.8	-0.1	-0.1	8	45	0.5	21.9	24.0

Table H135 : Office B
(Outputs from ASHRAE Thermal Comfort Program)

Level / Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Level 8	-1.14	32	comfortable	below	22.8	21.4	-0.2	-0.2	14	68	-0.8	21.9	21.7
Level 14	-1.02	27	comfortable	below	22.6	21.8	-0.2	-0.2	15	70	-1.1	21.9	21.3
Level 17	-0.75	17	comfortable	below	22.7	22.3	-0.2	-0.2	13	70	-0.7	21.9	21.9
Level 21	-0.82	19	comfortable	below	23.7	22.2	-0.2	-0.2	12	58	-0.5	21.9	22.2

Table H136 : Office C
(Outputs from ASHRAE Thermal Comfort Program)

Level / Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Ground Floor	0.51	10	comfortable	above	25.6	27.0	0.3	0.5	11	31	-0.1	21.9	23.0
Level 1	0.42	9	comfortable	in	25.1	26.2	0.2	0.2	12	36	-0.5	21.9	22.5

Table H137 : Office D
(Outputs from ASHRAE Thermal Comfort Program)

Level / Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Level 2	0.12	5	comfortable	in	24.3	23.4	0	0	11	51	-0.1	21.9	22.9
Level 4	0.01	5	comfortable	in	23.9	24.3	0	0	11	54	-0.2	21.9	22.8

Table H138 : Office E
(Outputs from ASHRAE Thermal Comfort Program)

Level / Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Human Resource Department	0.05	5	comfortable	in	24.0	23.1	-0.1	-0.1	12	55	-0.4	21.9	22.3
Corporate Department	-0.34	7	comfortable	in	23.3	22.9	-0.1	-0.1	12	63	-0.5	21.9	22.2

Table H139 : Office F
(Outputs from ASHRAE Thermal Comfort Program)

Level / Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Level 1	-0.68	15	comfortable	below	21.3, cool	21.3	-0.2	-0.2	15	86	-1.2	21.9	21.0
Ground Floor	-0.08	5	comfortable	in	23.6	23.2	-0.1	-0.1	12	61	-0.3	21.9	22.6

Table H140 : Office G
(Outputs from ASHRAE Thermal Comfort Program)

Level / Department	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
Level 19, Tower 1	0.31	7	comfortable	in	24.2	24.1	0	0	17	68	-0.2	21.9	22.8
Level 20, Tower 1	-0.49	10	comfortable	in	23.8	23.3	-0.1	-0.1	22	79	-0.4	21.9	22.4
Level 10, Tower 2	0.08	5	comfortable	in	23.7	22.7	-0.1	-0.1	12	58	-0.4	21.9	22.5
Level 15, Tower 2	-0.75	17	comfortable	below	23.1	22.1	-0.2	-0.2	12	65	-0.3	21.9	22.5
Level 26, Tower 2	-0.93	23	comfortable	below	21.6, cool	20.1	-0.2	-0.2	15	87	-0.9	21.9	21.5

Appendix I : Graphs of actual mean vote versus operative temperature for offices

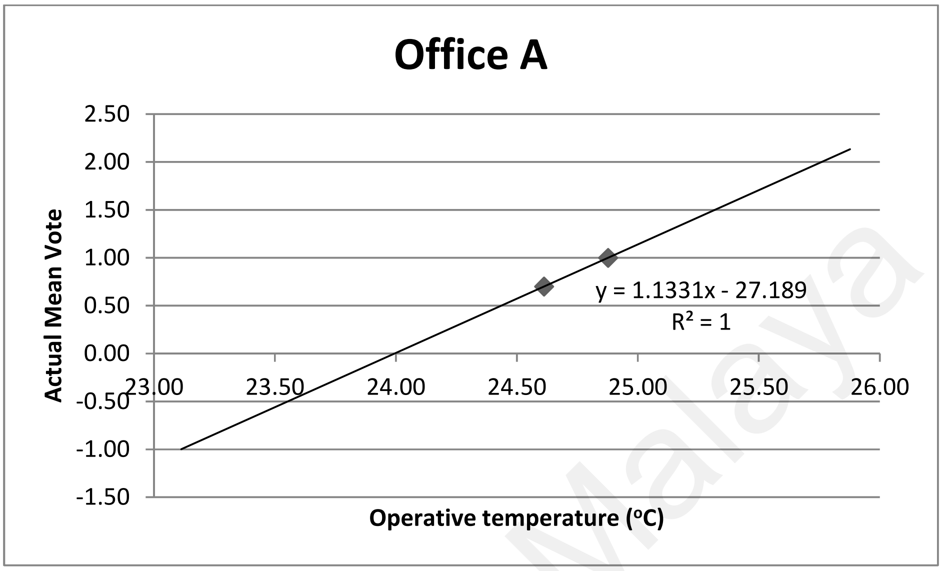

Figure I1 : Graph of AMV vs T_{op} for Office A.

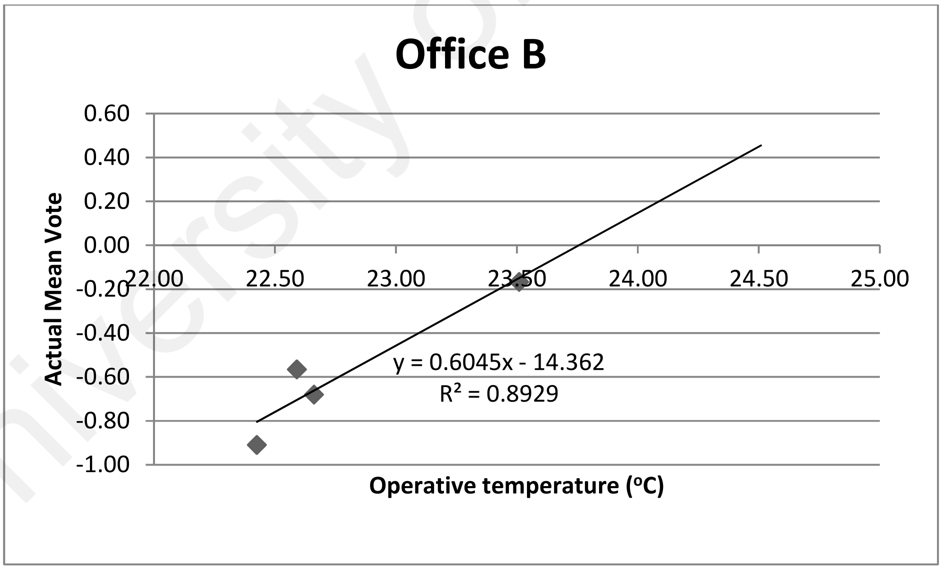

Figure I2 : Graph of AMV vs T_{op} for Office B.

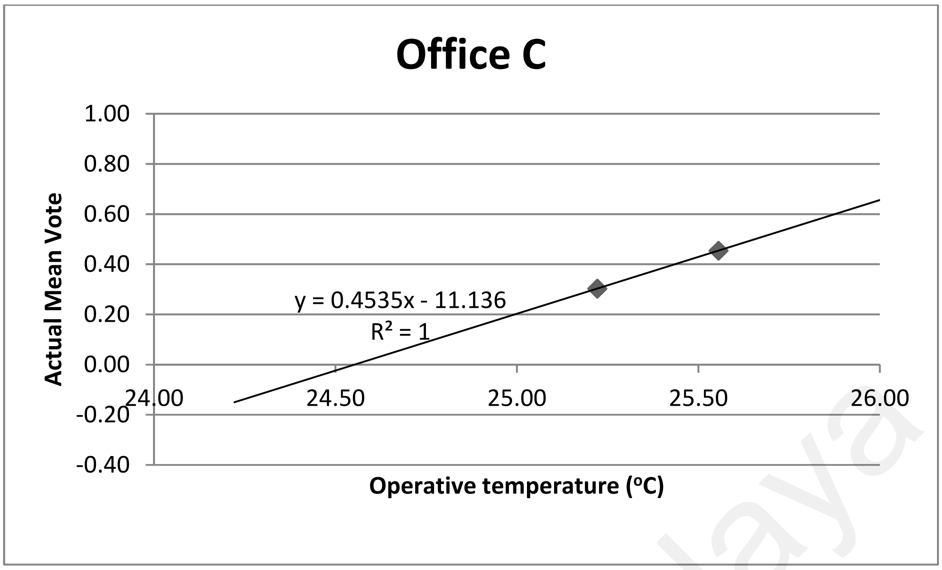

Figure I3 : Graph of AMV vs T_{op} for Office C.

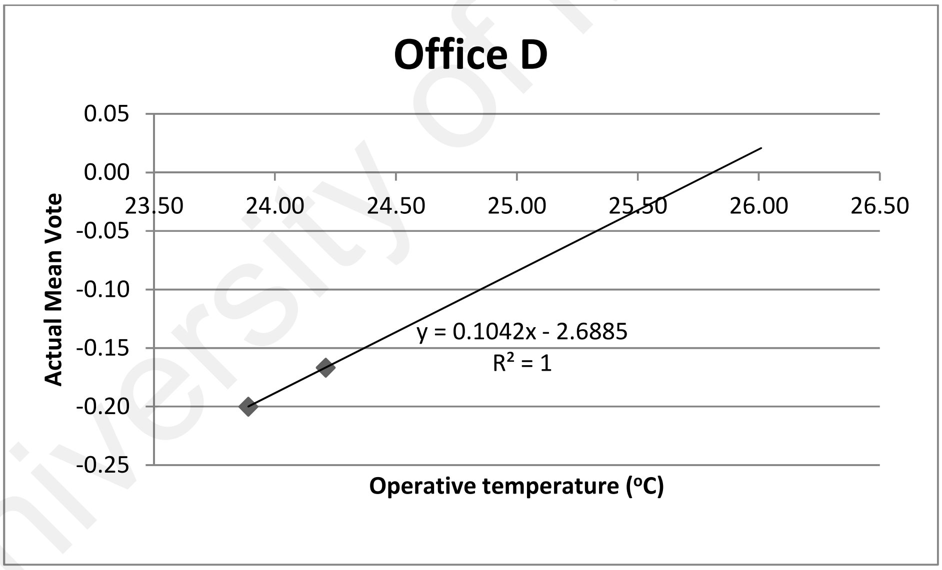

Figure I4 : Graph of AMV vs T_{op} for Office D.

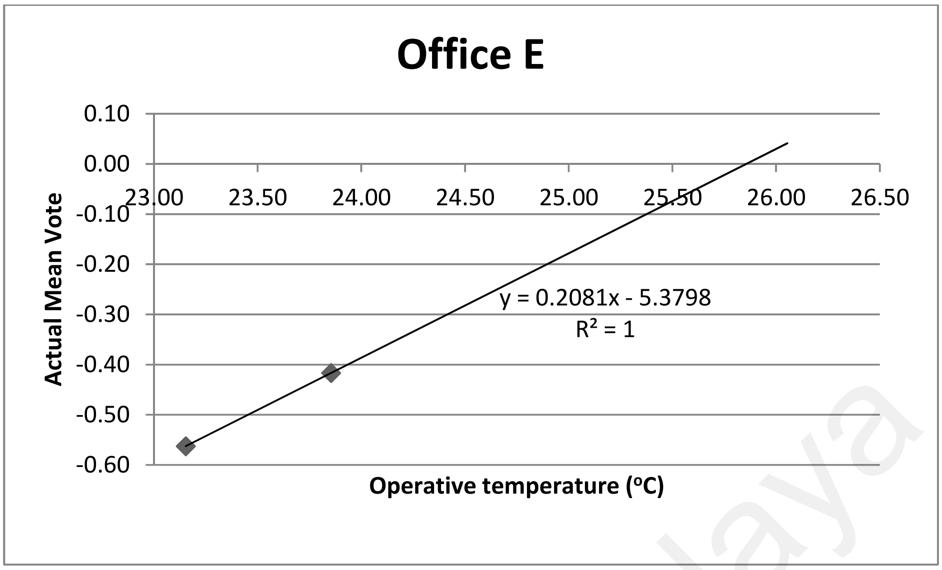

Figure I5 : Graph of AMV vs T_{op} for Office E.

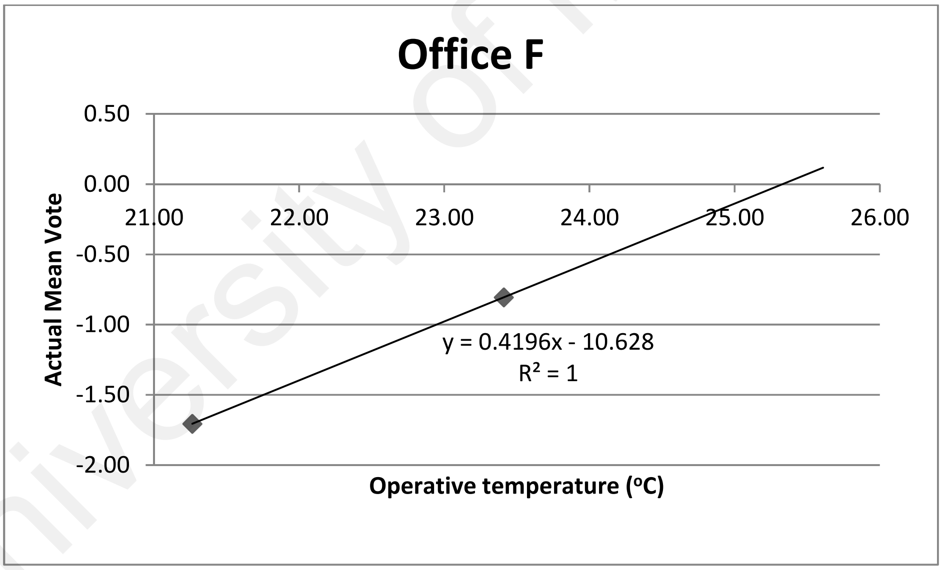

Figure I6 : Graph of AMV vs T_{op} for Office F.

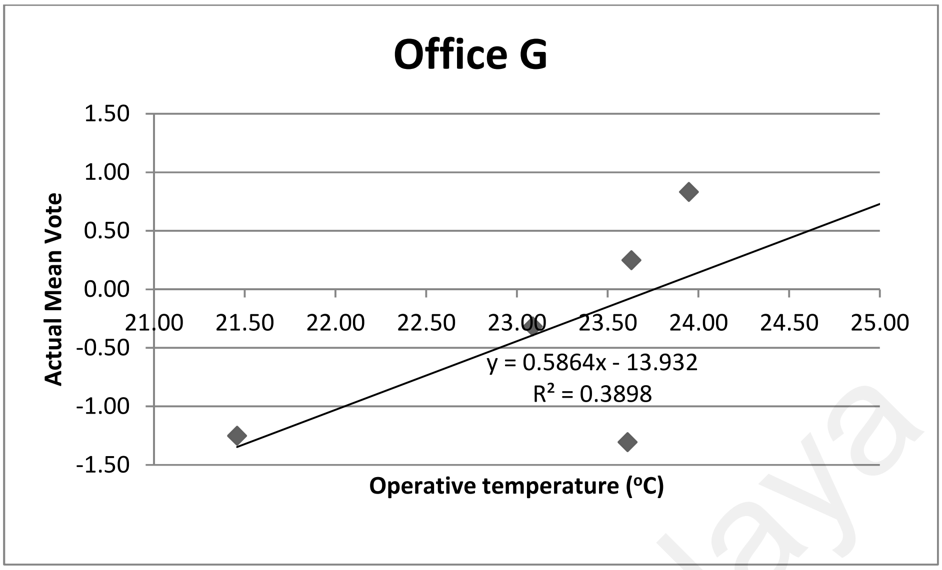

Figure I7 : Graph of AMV vs T_{op} for Office G.

Appendix J : Residual analysis for offices

No.	Explanatory variable, T_{out} (°C)	Response variable, T_n (°C)	Fitted value, T_n (°C)	Residual, e = Response variable - Fitted value
1	29.40	24.00	24.41	-0.41
2	28.60	23.76	24.30	-0.54
3	34.50	24.56	25.08	-0.53
4	33.40	25.80	24.94	0.86
5	30.80	25.85	24.59	1.26
6	32.46	25.33	24.81	0.52
7	33.30	23.76	24.92	-1.17

Appendix K : Bias uncertainty analysis for offices

Table K1 : Bias uncertainty for Office A - Level 1

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.04	23.9	26.5	45.8	28.5
2	0.01	23.9	26.6	56.9	29.1
3	0.02	23.9	26.0	57.3	30.1
4	0.01	23.9	25.9	58.0	30.2
5	0.02	23.9	25.6	58.7	30.2
6	0.02	23.9	25.6	59.5	30.1
7	0.01	23.9	25.8	60.5	29.3
8	0.01	23.9	25.8	60.5	27.6
9	0.01	23.9	25.9	60.5	28.8
10	0.01	23.9	26.0	59.8	28.9
11	0.01	23.9	26.1	60.0	28.8
12	0.01	23.9	26.0	58.7	28.7
13	0.01	23.9	26.1	59.8	28.9
14	0.01	23.9	26.0	57.9	29.2
15	0.02	23.9	26.3	58.1	29.3
Average	0.02	23.9	26.0	58.1	29.2
Maximum	0.04	23.9	26.6	60.5	30.2
Minimum	0.01	23.9	25.6	45.8	27.6
Count	15	15	15	15	15
Bias Uncertainty	0.002	0.00	0.07	0.98	0.17
Error (%)	10.38	0.00	0.26	1.69	0.59

Table K2 : Bias uncertainty for Office A - Level 2

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.02	24.3	26.4	60.5	29.1
2	0.02	24.3	26.7	59.5	29.5
3	0.03	24.3	26.5	59.8	30.5
4	0.02	24.3	26.7	59.4	30.6
5	0.02	24.3	26.5	60.5	30.6
6	0.04	24.3	26.5	61.1	30.5
7	0.02	24.3	26.4	61.2	29.7
8	0.06	24.3	26.3	61.9	29.0
9	0.02	24.3	26.4	61.4	29.2
10	0.02	24.3	26.3	61.4	29.3
11	0.02	24.3	26.3	61.0	28.9
12	0.02	24.3	26.2	60.9	28.1
13	0.02	24.3	26.3	60.9	29.3
14	0.02	24.3	26.2	59.6	29.6

15	0.02	24.3	26.3	59.7	29.7
16	0.02	24.3	26.1	59.8	29.4
17	0.06	24.3	26.2	59.8	30.0
Average	0.03	24.3	26.4	60.5	29.6
Maximum	0.06	24.3	26.7	61.9	30.6
Minimum	0.02	24.3	26.1	59.4	28.1
Count	17	17	17	17	17
Bias Uncertainty	0.002	0.00	0.04	0.15	0.15
Error (%)	8.89	0.00	0.13	0.24	0.50

Table K3 : Bias uncertainty for Office B - Level 8

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.10	22.8	21.8	52.2	26.8
2	0.09	22.8	21.8	52.5	28.4
3	0.06	22.9	21.7	52.5	29.4
4	0.14	22.9	21.9	52.2	29.4
5	0.16	22.8	22.3	51.4	29.4
6	0.07	22.5	22.2	51.1	29.3
7	0.08	22.4	22.1	50.8	28.5
8	0.10	22.8	21.1	51.1	26.9
9	0.13	23.2	21.1	53.0	28.1
10	0.08	22.9	20.9	53.6	28.2
Average	0.10	22.8	21.7	52.0	28.5
Maximum	0.16	23.2	22.3	53.6	29.4
Minimum	0.06	22.4	20.9	50.8	26.8
Count	10	10	10	10	10
Bias Uncertainty	0.010	0.07	0.14	0.28	0.26
Error (%)	9.90	0.32	0.65	0.54	0.92

Table K4 : Bias uncertainty for Office B - Level 14

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.06	22.7	20.8	53.9	26.1
2	0.15	22.7	20.9	53.1	27.2
3	0.06	22.8	20.9	53.0	28.2
4	0.05	22.9	21.1	53.2	28.2
5	0.06	22.7	21.3	53.3	28.2
6	0.08	22.4	21.3	53.2	28.2
7	0.09	22.3	21.1	53.1	27.4
8	0.09	22.7	20.8	53.1	26.7
9	0.07	22.8	20.5	53.3	27.0
10	0.10	22.6	20.5	53.4	27.0
11	0.14	23.1	19.6	53.6	26.0
Average	0.09	22.7	20.8	53.3	27.3
Maximum	0.15	23.1	21.3	53.9	28.2
Minimum	0.05	22.3	19.6	53.0	26.0
Count	11	11	11	11	11
Bias Uncertainty	0.009	0.07	0.15	0.08	0.20
Error (%)	10.53	0.29	0.74	0.15	0.75

Table K5 : Bias uncertainty for Office B - Level 17.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.09	22.7	22.0	58.2	28.0
2	0.11	22.7	21.7	58.2	28.8
3	0.08	22.9	21.7	58.0	29.8
4	0.10	23.1	21.2	59.5	29.9
5	0.10	22.9	21.3	59.5	29.9
6	0.12	22.4	21.3	61.5	29.8
7	0.04	22.3	21.2	63.0	29.0
8	0.08	22.9	21.4	63.3	27.7
9	0.09	23.1	21.7	64.6	28.5
10	0.07	22.9	22.1	64.5	28.6
11	0.06	23.1	22.3	63.4	27.8
12	0.10	22.8	22.5	62.6	27.9
13	0.08	22.8	22.7	62.3	28.6
14	0.08	22.4	22.8	62.3	28.9
15	0.10	22.4	22.9	63.5	29.0
16	0.02	22.3	22.6	64.4	28.7
17	0.09	22.5	22.6	64.2	29.3
18	0.06	22.6	22.5	64.2	29.7
Average	0.08	22.7	22.0	62.1	28.9
Maximum	0.12	23.1	22.9	64.6	29.9

Minimum	0.02	22.3	21.2	58.0	27.7
Count	18	18	18	18	18
Bias Uncertainty	0.006	0.04	0.09	0.37	0.12
Error (%)	6.80	0.18	0.43	0.59	0.43

Table K6 : Bias uncertainty for Office B - Level 21.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.06	23.7	23.0	59.4	28.1
2	0.06	23.8	22.7	59.9	29.7
3	0.07	23.6	22.6	60.4	30.6
4	0.07	23.7	22.5	61.0	30.7
Average	0.07	23.7	22.7	60.2	29.8
Maximum	0.07	23.8	23.0	61.0	30.7
Minimum	0.06	23.6	22.5	59.4	28.1
Count	4	4	4	4	4
Bias Uncertainty	0.003	0.05	0.13	0.40	0.65
Error (%)	3.85	0.21	0.55	0.66	2.19

Table K7 : Bias uncertainty for Office C - Ground Floor.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.05	26.3	23.4	43.3	34.6
2	0.07	25.9	23.8	47.8	35.3
3	0.11	25.8	24.0	48.0	36.5
4	0.09	25.8	24.0	48.2	36.6
5	0.09	25.8	23.9	48.3	36.6
6	0.12	25.8	23.0	48.5	36.5
7	0.10	25.7	23.2	48.7	35.5
8	0.05	25.7	23.7	49.0	34.7
9	0.06	25.6	26.1	49.5	34.9
10	0.07	25.7	26.1	49.7	35.1
11	0.11	25.7	25.1	50.0	34.3
12	0.09	25.7	25.0	50.2	34.2
13	0.09	25.7	24.8	50.4	35.1
14	0.09	25.6	25.1	50.6	35.4
15	0.09	25.6	25.4	50.9	35.5
Average	0.09	25.8	24.4	48.9	35.4
Maximum	0.12	26.3	26.1	50.9	36.6
Minimum	0.05	25.6	23.0	43.3	34.2
Count	15	15	15	15	15
Bias Uncertainty	0.005	0.05	0.21	0.51	0.16
Error (%)	5.47	0.18	0.85	1.04	0.46

Table K8 : Bias uncertainty for Office C – Level 1.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.09	27.3	23.6	41.6	33.0
2	0.12	27.0	23.2	42.4	33.5
3	0.07	26.4	23.8	43.2	34.7
4	0.09	26.2	23.6	43.0	34.8
5	0.04	26.0	23.1	41.9	34.8
6	0.04	25.8	23.0	43.3	34.7
7	0.07	25.7	22.9	42.1	33.7
8	0.10	25.5	23.2	42.8	32.9
9	0.02	25.0	22.7	42.6	33.2
10	0.07	24.9	23.0	41.8	33.3
11	0.11	25.0	23.6	43.8	32.7
12	0.10	25.0	23.3	48.7	32.5
13	0.13	24.9	23.3	49.6	33.3
14	0.13	24.9	23.0	47.0	33.6
15	0.11	24.9	23.3	46.9	33.7
16	0.10	24.9	22.9	46.7	33.4
Average	0.09	25.6	23.2	44.2	33.6
Maximum	0.13	27.3	23.8	49.6	34.8
Minimum	0.02	24.9	22.7	41.6	32.5
Count	16	16	16	16	16
Bias Uncertainty	0.007	0.15	0.07	0.50	0.14
Error (%)	7.91	0.59	0.30	1.13	0.43

Table K9 : Bias uncertainty for Office D - Level 2.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.03	24.9	24.9	51.9	31.7
2	0.03	24.6	24.6	52.8	33.5
3	0.04	24.0	24.0	53.8	34.4
4	0.04	23.3	23.3	53.3	34.6
5	0.05	24.2	24.2	52.7	34.6
6	0.06	24.2	24.2	52.9	34.5
7	0.05	24.2	24.2	52.9	33.7
8	0.03	24.2	24.2	53.3	31.9
Average	0.04	24.2	24.2	52.9	33.6
Maximum	0.06	24.9	24.9	53.8	34.6
Minimum	0.03	23.3	23.3	51.9	31.7
Count	8	8	8	8	8
Bias Uncertainty	0.004	0.20	0.20	0.24	0.36
Error (%)	9.09	0.83	0.83	0.45	1.07

Table K10 : Bias uncertainty for Office D - Level 4.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.02	24.9	24.9	51.0	31.3
2	0.03	24.8	24.8	52.1	33.1
3	0.02	24.8	24.8	53.3	34.2
4	0.02	24.2	24.2	53.0	34.3
5	0.04	23.9	23.9	53.4	34.3
6	0.03	23.4	23.4	53.5	34.1
7	0.03	23.1	23.1	54.2	33.3
8	0.04	23.4	23.4	53.1	31.4
9	0.02	23.1	23.1	52.8	32.8
10	0.04	23.4	23.4	52.4	32.9
Average	0.03	23.9	23.9	52.9	33.2
Maximum	0.04	24.9	24.9	54.2	34.3
Minimum	0.02	23.1	23.1	51.0	31.3
Count	10	10	10	10	10
Bias Uncertainty	0.002	0.18	0.18	0.32	0.30
Error (%)	6.90	0.75	0.75	0.61	0.92

Table K11 : Bias uncertainty for Office E - Human Resource Department.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.05	24.5	23.3	60.3	29.2
2	0.04	24.3	23.0	61.1	30.9
3	0.04	24.2	22.7	62.0	31.3
4	0.06	23.9	22.8	63.3	31.8
5	0.06	23.8	22.9	62.8	31.7
Average	0.05	24.1	22.9	61.9	31.0
Maximum	0.06	24.5	23.3	63.3	31.8
Minimum	0.04	23.8	22.7	60.3	29.2
Count	5	5	5	5	5
Bias Uncertainty	0.004	0.14	0.12	0.60	0.51
Error (%)	8.00	0.58	0.52	0.97	1.65

Table K12 : Bias uncertainty for Office E - Corporate Department.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.03	23.3	22.8	59.8	30.3
2	0.04	23.4	22.6	58.1	30.5
3	0.03	23.4	22.9	58.1	30.8
4	0.03	23.4	22.3	64.3	30.7
5	0.04	23.3	22.7	63.3	30.7
Average	0.03	23.4	22.7	60.7	30.6
Maximum	0.04	23.4	22.9	64.3	30.8
Minimum	0.03	23.3	22.3	58.1	30.3
Count	5	5	5	5	5
Bias Uncertainty	0.002	0.02	0.12	1.24	0.10
Error (%)	5.88	0.09	0.53	2.04	0.33

Table K13 : Bias uncertainty for Office F - Level 1.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.06	21.4	21.8	53.2	30.6
2	0.05	21.4	21.3	52.6	32.3
3	0.11	21.4	20.6	54.6	33.4
4	0.14	21.4	20.3	55.7	33.4
5	0.08	21.4	20.2	55.4	33.5
6	0.14	21.4	20.1	56.3	33.4
7	0.09	21.5	19.9	57.4	32.5
8	0.10	21.5	19.7	56.1	30.7
9	0.05	21.5	19.4	58.4	32.0
10	0.05	21.4	19.1	57.9	32.1
Average	0.09	21.4	20.2	55.8	32.4
Maximum	0.14	21.5	21.8	58.4	33.5
Minimum	0.05	21.4	19.1	52.6	30.6
Count	10	10	10	10	10
Bias Uncertainty	0.009	0.01	0.27	0.58	0.30
Error (%)	10.34	0.05	1.33	1.04	0.92

Table K14 : Bias uncertainty for Office F - Ground Floor.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.13	24.7	24.7	58.6	30.7
2	0.12	23.0	23.0	61.4	32.4
3	0.08	23.7	23.7	60.3	33.6
4	0.09	23.3	23.3	61.5	33.7
5	0.10	23.1	23.1	62.7	33.7
6	0.11	23.1	23.1	62.7	33.5
7	0.06	23.3	23.3	62.7	32.6
8	0.08	23.4	23.4	62.4	30.8
9	0.05	23.2	23.2	62.7	32.1
10	0.05	23.3	23.3	64.8	32.2
Average	0.09	23.4	23.4	62.0	32.5
Maximum	0.13	24.7	24.7	64.8	33.7
Minimum	0.05	23.0	23.0	58.6	30.7
Count	10	10	10	10	10
Bias Uncertainty	0.008	0.17	0.17	0.62	0.30
Error (%)	9.56	0.74	0.74	1.00	0.91

Table K15 : Bias uncertainty for Office G - Level 19, Tower 1.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.16	24.0	24.1	57.7	35.9
2	0.18	23.9	23.7	57.8	35.7
3	0.12	23.9	24.2	57.0	34.8
4	0.12	23.9	24.2	57.7	34.0
5	0.09	24.0	24.2	57.9	34.3
6	0.13	23.9	23.9	57.8	34.4
7	0.20	24.0	23.9	58.2	34.2
8	0.16	24.0	23.0	58.6	34.2
Average	0.15	24.0	23.9	57.8	34.7
Maximum	0.20	24.0	24.2	58.6	35.9
Minimum	0.09	23.9	23.0	57.0	34.0
Count	8	8	8	8	8
Bias Uncertainty	0.014	0.01	0.15	0.20	0.24
Error (%)	9.48	0.05	0.63	0.35	0.68

Table K16 : Bias uncertainty for Office G - Level 20, Tower 1.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.20	24.4	24.4	56.0	31.6
2	0.26	23.7	23.4	59.7	33.4
3	0.20	23.6	23.4	59.6	34.6
4	0.10	23.5	23.4	59.0	34.7
5	0.10	23.6	23.1	59.9	34.7
6	0.10	23.5	23.0	60.4	34.5
7	0.28	23.5	22.5	61.5	33.6
8	0.20	23.5	22.6	61.4	31.7
9	0.20	23.4	22.6	60.9	33.1
10	0.20	23.4	22.7	61.1	33.2
Average	0.18	23.6	23.1	60.0	33.5
Maximum	0.28	24.4	24.4	61.5	34.7
Minimum	0.10	23.4	22.5	56.0	31.6
Count	10	10	10	10	10
Bias Uncertainty	0.018	0.10	0.19	0.55	0.31
Error (%)	9.78	0.42	0.82	0.92	0.92

Table K17 : Bias uncertainty for Office G - Level 10, Tower 2.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.08	23.7	22.9	60.4	33.7
2	0.10	23.7	23.2	59.6	33.4
3	0.08	23.7	23.6	57.6	34.0
Average	0.09	23.7	23.2	59.2	33.7
Maximum	0.10	23.7	23.6	60.4	34.0
Minimum	0.08	23.7	22.9	57.6	33.4
Count	3	3	3	3	3
Bias Uncertainty	0.007	0.00	0.23	0.93	0.20
Error (%)	7.69	0.00	1.00	1.58	0.59

Table K18 : Bias uncertainty for Office G - Level 15, Tower 2.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.06	22.9	23.2	59.2	33.7
2	0.14	22.8	23.1	59.6	33.9
3	0.06	22.9	23.3	59.4	33.9
4	0.09	23.0	23.3	59.8	33.9
5	0.13	23.0	22.8	60.7	33.8
6	0.06	23.1	23.2	59.9	33.5
7	0.08	23.1	23.4	58.9	33.9
8	0.06	23.1	23.5	57.6	34.0
9	0.06	23.2	23.8	57.7	33.6
10	0.06	23.3	23.7	57.0	34.3
Average	0.08	23.0	23.3	59.0	33.8
Maximum	0.14	23.3	23.8	60.7	34.3
Minimum	0.06	22.8	22.8	57.0	33.5
Count	10	10	10	10	10
Bias Uncertainty	0.008	0.05	0.10	0.37	0.07
Error (%)	10.00	0.22	0.43	0.63	0.22

Table K19 : Bias uncertainty for Office G - Level 26, Tower 2.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.16	21.5	20.1	65.7	29.0
2	0.12	21.5	21.3	62.2	30.6
3	0.14	21.5	20.7	62.9	31.6
4	0.10	21.5	21.1	62.3	31.8
5	0.09	21.5	21.4	62.5	31.8
6	0.06	21.5	21.5	61.4	31.7
7	0.16	21.5	21.0	62.3	30.8
8	0.10	21.4	21.5	61.4	29.1
9	0.11	21.5	21.2	61.4	30.3
10	0.06	21.5	21.9	60.4	30.4
Average	0.11	21.5	21.2	62.3	30.7
Maximum	0.16	21.5	21.9	65.7	31.8
Minimum	0.06	21.4	20.1	60.4	29.0
Count	10	10	10	10	10
Bias Uncertainty	0.010	0.01	0.18	0.53	0.28
Error (%)	9.09	0.05	0.85	0.85	0.92

Appendix L : Detail measurements for lecture halls

Table L1 : Measurements of air temperature at Lecture Hall A.

Lecture Hall	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A	1	24.8	24.2	23.7	23.1	24.0
	2	22.5	22.5	22.0	21.3	22.1
	3	21.3	21.4	21.0	21.1	21.2
	4	20.5	19.8	19.1	19.4	19.7
	5	19.4	19.1	18.9	18.9	19.1
	6	19.0	19.0	19.1	19.1	19.1
	Total average					20.8

Table L2 : Measurements of globe temperature at Lecture Hall A.

Lecture Hall	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A	1	24.9	24.3	23.7	23.1	24.0
	2	24.8	24.8	24.2	23.4	24.3
	3	23.7	23.8	23.4	23.5	23.6
	4	24.2	23.4	22.6	22.9	23.3
	5	23.1	22.7	22.5	22.5	22.7
	6	22.4	22.4	22.6	22.6	22.5
	Total average					23.4

Table L3 : Measurements of air velocity at Lecture Hall A.

Lecture Hall	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A	1	0.16	0.12	0.14	0.12	0.14
	2	0.30	0.30	0.23	0.13	0.24
	3	0.29	0.23	0.23	0.07	0.21
	4	0.07	0.46	0.26	0.11	0.23
	5	0.23	0.25	0.17	0.20	0.21
	6	0.06	0.13	0.19	0.24	0.16
	Total average					0.20

Table L4 : Measurements of relative humidity at Lecture Hall A.

Lecture Hall	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
A	1	53.0	51.3	51.2	49.3	51.2
	2	49.6	48.8	48.3	47.3	48.5
	3	47.5	47.6	47.5	47.1	47.4
	4	46.1	46.3	45.7	46.0	46.0
	5	46.8	46.6	46.0	46.4	46.5
	6	46.3	46.7	46.6	46.1	46.4
	Total average					47.7

Table L5 : Measurements of metabolic rate at Lecture Hall A – Point 1.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Point 1	Seated quiet	1.0	1	1.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	3	3.6	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.6	1.15

Table L6 : Measurements of metabolic rate at Lecture Hall A – Point 2.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Point 2	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L7 : Measurements of metabolic rate at Lecture Hall A – Point 3.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Point 3	Seated quiet	1.0	6	6.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		6	6.0	1.00

Table L8 : Measurements of metabolic rate at Lecture Hall A – Point 4.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Point 4	Seated quiet	1.0	2	2.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.3	1.08

Table L9 : Measurements of metabolic rate at Lecture Hall A – Point 5.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Point 5	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L10 : Measurements of metabolic rate at Lecture Hall A – Point 6.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
A - Point 6	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L11 : Measurements of clothing value at Lecture Hall A – Point 1.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Point 1	Short-sleeve	0.19	2	0.38	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	4	1.44	
	Total		4	3.00	0.75

Table L12 : Measurements of clothing value at Lecture Hall A – Point 2.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Point 2	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	2	0.72	
	Total		4	2.16	0.54

Table L13 : Measurements of clothing value at Lecture Hall A – Point 3.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Point 3	Short-sleeve	0.19	2	0.38	
	Normal long-sleeve shirt	0.25	4	1.00	
	Normal trousers	0.15	6	0.90	
	Socks	0.02	0	0.00	
	Shoes	0.02	6	0.12	
	Jacket	0.36	6	2.16	
	Total		6	4.56	0.76

Table L14 : Measurements of clothing value at Lecture Hall A – Point 4.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Point 4	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	2	0.72	
	Total		4	2.16	0.54

Table L15 : Measurements of clothing value at Lecture Hall A – Point 5.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Point 5	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	3	1.08	
	Total		4	2.52	0.63

Table L16 : Measurements of clothing value at Lecture Hall A – Point 6.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
A - Point 6	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	0	0.00	
	Total		4	1.44	0.36

Table L17 : Measurements of AMV at Lecture Hall A – Point 1.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Point 1	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	2	2.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-1.0	-0.25

Table L18 : Measurements of AMV at Lecture Hall A – Point 2.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Point 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table L19 : Measurements of AMV at Lecture Hall A – Point 3.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Point 3	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		6	-7.0	-1.17

Table L20 : Measurements of AMV at Lecture Hall A – Point 4.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Point 4	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		4	-4.0	-1.00

Table L21 : Measurements of AMV at Lecture Hall A – Point 5.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Point 5	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	2	-4.0	
	Cold	-3	2	-6.0	
	Total		4	-10.0	-2.50

Table L22 : Measurements of AMV at Lecture Hall A – Point 6.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
A - Point 6	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	4	-8.0	
	Cold	-3	0	0.0	
	Total		4	-8.0	-2.00

Table L23 : Measurements of air temperature at Lecture Hall B.

Lecture Hall	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B	1	21.2	21.2	21.3	21.3	21.3
	2	21.2	21.3	21.5	21.4	21.4
	3	21.0	21.1	21.0	20.9	21.0
	4	21.0	21.0	20.8	20.8	20.9
	5	21.1	21.1	21.0	20.9	21.0
	6	21.0	21.0	21.1	21.0	21.0
	Total average					21.1

Table L24 : Measurements of globe temperature at Lecture Hall B.

Lecture Hall	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B	1	22.5	22.3	22.3	22.5	22.4
	2	22.5	22.4	22.5	22.7	22.5
	3	22.5	22.6	22.6	22.6	22.6
	4	22.5	22.8	22.4	22.7	22.6
	5	22.7	22.7	22.6	22.7	22.7
	6	22.5	22.5	22.8	23.0	22.7
	Total average					22.6

Table L25 : Measurements of air velocity at Lecture Hall B.

Lecture Hall	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B	1	0.24	0.14	0.28	0.22	0.22
	2	0.09	0.09	0.14	0.16	0.12
	3	0.14	0.16	0.16	0.22	0.17
	4	0.11	0.12	0.12	0.06	0.10
	5	0.15	0.15	0.12	0.20	0.16
	6	0.04	0.12	0.12	0.11	0.10
	Total average					0.15

Table L26 : Measurements of relative humidity at Lecture Hall B.

Lecture Hall	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
B	1	62.1	61.7	61.7	61.6	61.8
	2	62.5	62.3	63.8	61.5	62.5
	3	62.3	62.8	62.3	62.8	62.6
	4	63.6	63.4	62.7	62.8	63.1
	5	62.4	62.6	62.0	62.7	62.4
	6	63.0	63.0	63.1	63.0	63.0
	Total average					62.6

Table L27 : Measurements of metabolic rate at Lecture Hall B – Point 1.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Point 1	Seated quiet	1.0	2	2.0	
	Typing	1.1	2	2.2	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.4	1.08

Table L28 : Measurements of metabolic rate at Lecture Hall B – Point 2.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Point 2	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L29 : Measurements of metabolic rate at Lecture Hall B – Point 3.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Point 3	Seated quiet	1.0	2	2.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	3	3.6	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.6	1.12

Table L30 : Measurements of metabolic rate at Lecture Hall B – Point 4.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Point 4	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L31 : Measurements of metabolic rate at Lecture Hall B – Point 5.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Point 5	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L32 : Measurements of metabolic rate at Lecture Hall B – Point 6.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
B - Point 6	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L33 : Measurements of clothing value at Lecture Hall B – Point 1.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Point 1	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	3	1.08	
	Total		5	3.00	0.60

Table L34 : Measurements of clothing value at Lecture Hall B – Point 2.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Point 2	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	3	1.08	
	Total		5	2.88	0.58

Table L35 : Measurements of clothing value at Lecture Hall B – Point 3.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Point 3	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	5	1.80	
	Total		5	3.60	0.72

Table L36 : Measurements of clothing value at Lecture Hall B – Point 4.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Point 4	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	2	0.72	
	Total		5	2.52	0.50

Table L37 : Measurements of clothing value at Lecture Hall B – Point 5.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Point 5	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	5	1.80	
	Total		5	3.60	0.72

Table L38 : Measurements of clothing value at Lecture Hall B – Point 6.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
B - Point 6	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	5	1.80	
	Total		5	3.60	0.72

Table L39 : Measurements of AMV at Lecture Hall B – Point 1.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Point 1	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	3	3.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		5	-1.0	-0.20

Table L40 : Measurements of AMV at Lecture Hall B – Point 2.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Point 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	4	-8.0	
	Cold	-3	0	0.0	
	Total		5	-8.0	-1.60

Table L41 : Measurements of AMV at Lecture Hall B – Point 3.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Point 3	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		5	-7.0	-1.40

Table L42 : Measurements of AMV at Lecture Hall B – Point 4.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Point 4	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	5	-10.0	
	Cold	-3	0	0.0	
	Total		5	-10.0	-2.00

Table L43 : Measurements of AMV at Lecture Hall B – Point 5.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Point 5	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		5	-7.0	-1.40

Table L44 : Measurements of AMV at Lecture Hall B – Point 6.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
B - Point 6	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	3	3.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		5	1.0	0.20

Table L45 : Measurements of air temperature at Lecture Hall C.

Lecture Hall	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C	1	22.0	21.8	21.9	21.9	21.9
	2	22.4	22.3	22.3	21.8	22.2
	3	22.6	22.7	22.9	22.8	22.8
	4	22.8	22.8	22.5	22.5	22.7
	5	22.1	22.0	22.0	22.1	22.1
	6	22.0	22.0	21.9	21.9	22.0
	Total average					22.3

Table L46 : Measurements of globe temperature at Lecture Hall C.

Lecture Hall	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C	1	22.8	22.6	22.6	22.8	22.7
	2	22.7	22.6	22.7	22.9	22.7
	3	22.6	22.7	22.7	22.7	22.7
	4	22.6	22.9	22.5	22.8	22.7
	5	22.7	22.7	22.6	22.7	22.7
	6	22.4	22.4	22.7	22.9	22.6
	Total average					22.7

Table L47 : Measurements of air velocity at Lecture Hall C.

Lecture Hall	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C	1	0.12	0.21	0.20	0.20	0.18
	2	0.03	0.04	0.05	0.27	0.10
	3	0.06	0.10	0.13	0.12	0.10
	4	0.07	0.04	0.07	0.30	0.12
	5	0.09	0.13	0.06	0.20	0.12
	6	0.11	0.20	0.25	0.29	0.21
	Total average					0.14

Table L48 : Measurements of relative humidity at Lecture Hall C.

Lecture Hall	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
C	1	69.4	69.8	69.9	70.0	69.8
	2	68.2	68.1	67.9	67.6	68.0
	3	68.6	68.5	70.0	68.2	68.8
	4	66.8	67.0	67.2	67.2	67.1
	5	69.1	69.6	69.8	69.9	69.6
	6	69.0	69.8	69.9	70.1	69.7
	Total average					68.8

Table L49 : Measurements of metabolic rate at Lecture Hall C – Point 1.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C - Point 1	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L50 : Measurements of metabolic rate at Lecture Hall C – Point 2.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C - Point 2	Seated quiet	1.0	2	2.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.4	1.10

Table L51 : Measurements of metabolic rate at Lecture Hall C – Point 3.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C - Point 3	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L52 : Measurements of metabolic rate at Lecture Hall C – Point 4.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C - Point 4	Seated quiet	1.0	2	2.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	1	1.7	
	Total		4	4.8	1.20

Table L53 : Measurements of metabolic rate at Lecture Hall C – Point 5.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C - Point 5	Seated quiet	1.0	1	1.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	4	4.8	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.8	1.16

Table L54 : Measurements of metabolic rate at Lecture Hall C – Point 6.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
C - Point 6	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L55 : Measurements of clothing value at Lecture Hall C – Point 1.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C - Point 1	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	4	1.44	
	Total		4	2.88	0.72

Table L56 : Measurements of clothing value at Lecture Hall C – Point 2.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C - Point 2	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	3	1.08	
	Total		4	2.58	0.65

Table L57 : Measurements of clothing value at Lecture Hall C – Point 3.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C - Point 3	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	3	1.08	
	Total		4	2.52	0.63

Table L58 : Measurements of clothing value at Lecture Hall C – Point 4.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C - Point 4	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	4	1.44	
	Total		4	2.88	0.72

Table L59 : Measurements of clothing value at Lecture Hall C – Point 5.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C - Point 5	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	0	0.00	
	Total		5	1.86	0.37

Table L60 : Measurements of clothing value at Lecture Hall C – Point 6.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
C - Point 6	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	5	1.80	
	Total		5	3.60	0.72

Table L61 : Measurements of AMV at Lecture Hall C – Point 1.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Point 1	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table L62 : Measurements of AMV at Lecture Hall C – Point 2.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Point 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	1	-2.0	
	Cold	-3	0	0.0	
	Total		4	-5.0	-1.25

Table L63 : Measurements of AMV at Lecture Hall C – Point 3.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Point 3	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table L64 : Measurements of AMV at Lecture Hall C – Point 4.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Point 4	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table L65 : Measurements of AMV at Lecture Hall C – Point 5.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Point 5	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		5	-7.0	-1.40

Table L66 : Measurements of AMV at Lecture Hall C – Point 6.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
C - Point 6	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	5	-10.0	
	Cold	-3	0	0.0	
	Total		5	-10.0	-2.00

Table L67 : Measurements of air temperature at Lecture Hall D.

Lecture Hall	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D	1	22.7	23.0	23.0	23.0	22.9
	2	22.0	22.1	22.2	22.2	22.1
	3	22.0	22.1	22.3	22.3	22.2
	4	23.2	23.2	23.1	23.1	23.2
	5	22.0	21.7	22.0	22.1	22.0
	6	21.8	21.7	21.8	21.7	21.8
	Total average					22.3

Table L68 : Measurements of globe temperature at Lecture Hall D.

Lecture Hall	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D	1	22.9	22.3	21.9	21.3	22.1
	2	22.5	22.5	22.0	21.3	22.1
	3	22.3	22.4	22.0	22.1	22.2
	4	23.0	22.2	21.4	21.8	22.1
	5	22.6	22.2	22.0	22.0	22.2
	6	22.1	22.1	22.3	22.3	22.2
	Total average					22.2

Table L69 : Measurements of air velocity at Lecture Hall D.

Lecture Hall	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D	1	0.09	0.11	0.13	0.11	0.11
	2	0.12	0.14	0.07	0.16	0.12
	3	0.06	0.05	0.17	0.19	0.12
	4	0.04	0.08	0.11	0.18	0.10
	5	0.17	0.23	0.18	0.25	0.21
	6	0.08	0.17	0.14	0.19	0.15
	Total average					0.13

Table L70 : Measurements of relative humidity at Lecture Hall D.

Lecture Hall	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
D	1	48.4	49.8	49.2	48.9	49.1
	2	47.5	47.4	47.4	47.3	47.4
	3	48.3	48.4	48.3	47.8	48.2
	4	48.0	48.2	48.8	49.1	48.5
	5	49.9	49.7	50.1	50.0	49.9
	6	48.1	48.5	49.0	48.4	48.5
	Total average					48.6

Table L71 : Measurements of metabolic rate at Lecture Hall D – Point 1.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Point 1	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L72 : Measurements of metabolic rate at Lecture Hall D – Point 2.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Point 2	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L73 : Measurements of metabolic rate at Lecture Hall D – Point 3.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Point 3	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L74 : Measurements of metabolic rate at Lecture Hall D – Point 4.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Point 4	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L75 : Measurements of metabolic rate at Lecture Hall D – Point 5.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Point 5	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L76 : Measurements of metabolic rate at Lecture Hall D – Point 6.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
D - Point 6	Seated quiet	1.0	1	1.0	
	Typing	1.1	1	1.1	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.5	1.13

Table L77 : Measurements of clothing value at Lecture Hall D – Point 1.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Point 1	Short-sleeve	0.19	2	0.38	
	Normal long-sleeve shirt	0.25	3	0.75	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	3	1.08	
	Total		5	3.06	0.61

Table L78 : Measurements of clothing value at Lecture Hall D – Point 2.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Point 2	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	3	1.08	
	Total		4	2.52	0.63

Table L79 : Measurements of clothing value at Lecture Hall D – Point 3.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Point 3	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	4	1.44	
	Total		4	2.88	0.72

Table L80 : Measurements of clothing value at Lecture Hall D – Point 4.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Point 4	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	3	1.08	
	Total		4	2.52	0.63

Table L81 : Measurements of clothing value at Lecture Hall D – Point 5.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Point 5	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	5	1.80	
	Total		5	3.60	0.72

Table L82 : Measurements of clothing value at Lecture Hall D – Point 6.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
D - Point 6	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	2	0.72	
	Total		4	2.16	0.54

Table L83 : Measurements of AMV at Lecture Hall D – Point 1.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Point 1	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	1	1.0	
	Neutral	0	1	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		5	-4.0	-0.80

Table L84 : Measurements of AMV at Lecture Hall D – Point 2.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Point 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	1	-1.0	
	Cool	-2	3	-6.0	
	Cold	-3	0	0.0	
	Total		4	-7.0	-1.75

Table L85 : Measurements of AMV at Lecture Hall D – Point 3.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Point 3	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table L86 : Measurements of AMV at Lecture Hall D – Point 4.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Point 4	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table L87 : Measurements of AMV at Lecture Hall D – Point 5.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Point 5	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		5	-7.0	-1.40

Table L88 : Measurements of AMV at Lecture Hall D – Point 6.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
D - Point 6	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	2	2.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		4	-2.0	-0.50

Table L89 : Measurements of air temperature at Lecture Hall E.

Lecture Hall	Sampling Point	T_{air} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E	1	21.4	21.3	21.3	21.4	21.4
	2	21.6	21.5	21.6	21.8	21.6
	3	21.7	21.8	21.8	21.8	21.8
	4	21.3	21.5	21.2	21.4	21.4
	5	21.6	21.6	21.5	21.6	21.6
	6	20.8	20.8	21.1	21.3	21.0
	Total average					21.4

Table L90 : Measurements of globe temperature at Lecture Hall E.

Lecture Hall	Sampling Point	T_{globe} (°C)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E	1	22.5	22.3	22.3	22.5	22.4
	2	22.3	22.2	22.3	22.5	22.3
	3	22.2	22.3	22.3	22.3	22.3
	4	22.2	22.5	22.1	22.4	22.3
	5	22.4	22.4	22.3	22.4	22.4
	6	22.1	22.1	22.4	22.6	22.3
	Total average					22.3

Table L91 : Measurements of air velocity at Lecture Hall E.

Lecture Hall	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E	1	0.19	0.07	0.15	0.24	0.16
	2	0.23	0.17	0.09	0.28	0.19
	3	0.12	0.20	0.20	0.18	0.18
	4	0.16	0.34	0.10	0.08	0.17
	5	0.16	0.18	0.15	0.20	0.17
	6	0.06	0.09	0.12	0.18	0.11
	Total average					0.16

Table L92 : Measurements of relative humidity at Lecture Hall E.

Lecture Hall	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
E	1	48.1	48.2	48.4	47.7	48.1
	2	47.9	47.8	48.2	48.9	48.2
	3	47.6	47.6	47.8	47.7	47.7
	4	47.4	48.6	48.8	49.3	48.5
	5	49.1	48.7	48.9	49.2	49.0
	6	50.6	50.7	51.0	50.3	50.7
	Total average					48.7

Table L93 : Measurements of metabolic rate at Lecture Hall E – Point 1.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Point 1	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.2	1.04

Table L94 : Measurements of metabolic rate at Lecture Hall E – Point 2.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Point 2	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L95 : Measurements of metabolic rate at Lecture Hall E – Point 3.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Point 3	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L96 : Measurements of metabolic rate at Lecture Hall E – Point 4.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Point 4	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		5	5.0	1.00

Table L97 : Measurements of metabolic rate at Lecture Hall E – Point 5.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Point 5	Seated quiet	1.0	2	2.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	3	4.2	
	Walking about	1.7	0	0.0	
	Total		5	6.2	1.24

Table L98 : Measurements of metabolic rate at Lecture Hall E – Point 6.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
E - Point 6	Seated quiet	1.0	4	4.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		4	4.0	1.00

Table L99 : Measurements of clothing value at Lecture Hall E – Point 1.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Point 1	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	5	1.80	
	Total		5	3.60	0.72

Table L100 : Measurements of clothing value at Lecture Hall E – Point 2.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Point 2	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	4	1.44	
	Total		4	2.88	0.72

Table L101 : Measurements of clothing value at Lecture Hall E – Point 3.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Point 3	Short-sleeve	0.19	5	0.95	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	5	1.80	
	Total		5	3.60	0.72

Table L102 : Measurements of clothing value at Lecture Hall E – Point 4.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Point 4	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	4	1.44	
	Total		5	3.30	0.66

Table L103 : Measurements of clothing value at Lecture Hall E – Point 5.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Point 5	Short-sleeve	0.19	3	0.57	
	Normal long-sleeve shirt	0.25	2	0.50	
	Normal trousers	0.15	5	0.75	
	Socks	0.02	0	0.00	
	Shoes	0.02	5	0.10	
	Jacket	0.36	4	1.44	
	Total		5	3.36	0.67

Table L104 : Measurements of clothing value at Lecture Hall E – Point 6.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
E - Point 6	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	4	0.60	
	Socks	0.02	0	0.00	
	Shoes	0.02	4	0.08	
	Jacket	0.36	3	1.08	
	Total		4	2.52	0.63

Table L105 : Measurements of AMV at Lecture Hall E – Point 1.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Point 1	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		5	-7.0	-1.40

Table L106 : Measurements of AMV at Lecture Hall E – Point 2.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Point 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		4	-6.0	-1.50

Table L107 : Measurements of AMV at Lecture Hall E – Point 3.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Point 3	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		5	-7.0	-1.40

Table L108 : Measurements of AMV at Lecture Hall E – Point 4.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Point 4	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	3	-3.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		5	-7.0	-1.40

Table L109 : Measurements of AMV at Lecture Hall E – Point 5.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Point 5	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	1	-3.0	
	Total		5	-7.0	-1.40

Table L110 : Measurements of AMV at Lecture Hall E – Point 6.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
E - Point 6	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	2	-2.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		4	-6.0	-1.50

Table L111 : Measurements of air temperature at Lecture Hall F.

Lecture Hall	Sampling Point	T_{air} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F	1	24.7	24.6	24.7	24.5	24.6
	2	24.5	24.6	24.6	24.6	24.6
	3	25.0	25.0	25.1	25.0	25.0
	4	25.2	25.2	25.3	25.3	25.3
	5	25.3	25.3	25.3	25.4	25.3
	6	25.4	25.4	25.3	25.1	25.3
	Total average					25.0

Table L112 : Measurements of globe temperature at Lecture Hall F.

Lecture Hall	Sampling Point	T_{globe} (^oC)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F	1	26.7	26.1	25.5	24.9	25.8
	2	26.1	26.1	25.5	24.7	25.6
	3	25.3	25.4	25.0	25.1	25.2
	4	26.2	25.3	24.4	24.8	25.2
	5	25.7	25.3	25.1	25.1	25.3
	6	25.1	25.1	25.3	25.3	25.2
	Total average					25.4

Table L113 : Measurements of air velocity at Lecture Hall F.

Lecture Hall	Sampling Point	V (m/s)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F	1	0.06	0.07	0.14	0.12	0.10
	2	0.08	0.04	0.06	0.17	0.09
	3	0.15	0.09	0.09	0.22	0.14
	4	0.03	0.05	0.15	0.16	0.10
	5	0.07	0.05	0.06	0.18	0.09
	6	0.02	0.07	0.08	0.18	0.09
	Total average					0.10

Table L114 : Measurements of relative humidity at Lecture Hall F.

Lecture Hall	Sampling Point	RH (%)				
		0.1 m	0.6 m	1.1 m	1.7 m	Average
F	1	60.8	61.0	61.7	61.9	61.4
	2	61.6	61.8	62.0	61.6	61.8
	3	64.0	63.4	63.4	62.9	63.4
	4	63.6	63.6	64.2	63.7	63.8
	5	62.7	61.6	61.5	62.5	62.1
	6	63.1	61.1	60.6	61.1	61.5
	Total average					62.3

Table L115 : Measurements of metabolic rate at Lecture Hall F – Point 1.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Point 1	Seated quiet	1.0	6	6.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		7	7.4	1.06

Table L116 : Measurements of metabolic rate at Lecture Hall F – Point 2.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Point 2	Seated quiet	1.0	6	6.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	1	1.2	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		7	7.2	1.03

Table L117 : Measurements of metabolic rate at Lecture Hall F – Point 3.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Point 3	Seated quiet	1.0	6	6.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		7	7.4	1.06

Table L118 : Measurements of metabolic rate at Lecture Hall F – Point 4.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Point 4	Seated quiet	1.0	6	6.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	0	0.0	
	Filing (standing)	1.4	1	1.4	
	Walking about	1.7	0	0.0	
	Total		7	7.4	1.06

Table L119 : Measurements of metabolic rate at Lecture Hall F – Point 5.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Point 5	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		7	7.4	1.06

Table L120 : Measurements of metabolic rate at Lecture Hall F – Point 6.

Lecture Hall	Activity Level	Metabolic rate			
		met	No. of people	met*people	Average
F - Point 6	Seated quiet	1.0	5	5.0	
	Typing	1.1	0	0.0	
	Standing relaxed	1.2	2	2.4	
	Filing (standing)	1.4	0	0.0	
	Walking about	1.7	0	0.0	
	Total		7	7.4	1.06

Table L121 : Measurements of clothing value at Lecture Hall F – Point 1.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Point 1	Short-sleeve	0.19	7	1.33	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	0	0.00	
	Shoes	0.02	7	0.14	
	Jacket	0.36	7	2.52	
	Total		7	5.04	0.72

Table L122 : Measurements of clothing value at Lecture Hall F – Point 2.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Point 2	Short-sleeve	0.19	6	1.14	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	0	0.00	
	Shoes	0.02	7	0.14	
	Jacket	0.36	7	2.52	
	Total		7	5.10	0.73

Table L123 : Measurements of clothing value at Lecture Hall F – Point 3.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Point 3	Short-sleeve	0.19	7	1.33	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	0	0.00	
	Shoes	0.02	7	0.14	
	Jacket	0.36	4	1.44	
	Total		7	3.96	0.57

Table L124 : Measurements of clothing value at Lecture Hall F – Point 4.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Point 4	Short-sleeve	0.19	6	1.14	
	Normal long-sleeve shirt	0.25	1	0.25	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	0	0.00	
	Shoes	0.02	7	0.14	
	Jacket	0.36	3	1.08	
	Total		7	3.66	0.52

Table L125 : Measurements of clothing value at Lecture Hall F – Point 5.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Point 5	Short-sleeve	0.19	7	1.33	
	Normal long-sleeve shirt	0.25	0	0.00	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	0	0.00	
	Shoes	0.02	7	0.14	
	Jacket	0.36	7	2.52	
	Total		7	5.04	0.72

Table L126 : Measurements of clothing value at Lecture Hall F – Point 6.

Lecture Hall	Clothing Insulation	Clothing value			
		clo	No. of people	clo*people	Average
F - Point 6	Short-sleeve	0.19	4	0.76	
	Normal long-sleeve shirt	0.25	3	0.75	
	Normal trousers	0.15	7	1.05	
	Socks	0.02	0	0.00	
	Shoes	0.02	7	0.14	
	Jacket	0.36	2	0.72	
	Total		7	3.42	0.49

Table L127 : Measurements of AMV at Lecture Hall F – Point 1.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Point 1	Hot	3	0	0.0	
	Warm	2	4	8.0	
	Slightly warm	1	3	3.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		7	11.0	1.57

Table L128 : Measurements of AMV at Lecture Hall F – Point 2.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Point 2	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	7	7.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		7	7.0	1.00

Table L129 : Measurements of AMV at Lecture Hall F – Point 3.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Point 3	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	5	-5.0	
	Cool	-2	2	-4.0	
	Cold	-3	0	0.0	
	Total		7	-9.0	-1.29

Table L130 : Measurements of AMV at Lecture Hall F – Point 4.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Point 4	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	0	0.0	
	Slightly cool	-1	7	-7.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		7	-7.0	-1.00

Table L131 : Measurements of AMV at Lecture Hall F – Point 5.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Point 5	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	7	0.0	
	Slightly cool	-1	0	0.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		7	0.0	0.00

Table L132 : Measurements of AMV at Lecture Hall F – Point 6.

Lecture Hall	Thermal Sensation Scale	Actual Mean Vote			
		Scale	No. of votes	Scale*votes	Average
F - Point 6	Hot	3	0	0.0	
	Warm	2	0	0.0	
	Slightly warm	1	0	0.0	
	Neutral	0	3	0.0	
	Slightly cool	-1	4	-4.0	
	Cool	-2	0	0.0	
	Cold	-3	0	0.0	
	Total		7	-4.0	-0.57

Table L133 : Lecture Hall A (Outputs from ASHRAE Thermal Comfort Program)

Point	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
1	-0.07	5	comfortable	in	24.0	25.0	0	0	15, draft risk	65	-0.2	21.9	22.8
2	-1.15	33	comfortable	below	24.5	22.8	-0.2	-0.2	33, draft risk	79	-0.7	21.9	21.9
3	-0.77	17	comfortable	below	23.7	23.9	-0.1	-0.1	30, draft risk	82	-1.0	21.9	21.5
4	-1.23	37	comfortable	below	23.6	22.5	-0.2	-0.2	37	87	-1.4	21.9	20.8
5	-1.49	51	comfortable	below	23.0, cool	22.2	-0.2	-0.2	35	91	-1.5	21.9	20.5
6	-2.39	91	comfortable	below	22.7, cool	20.2	-0.4	-0.4	26	84	-1.6	21.9	20.4

Table L134 : Lecture Hall B (Outputs from ASHRAE Thermal Comfort Program)

Point	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
1	-1.08	30	comfortable	below	22.7, cool	22.1	-0.2	-0.2	32, draft risk	100	-0.9	21.9	21.5
2	-1.14	32	comfortable	below	22.7, cool	22.3	-0.2	-0.2	17, draft risk	76	-0.8	21.9	21.6
3	-0.62	13	comfortable	below	22.9, cool	23.7	-0.1	-0.1	24, draft risk	87	-0.9	21.9	21.4
4	-1.36	43	comfortable	below	22.8, cool	21.7	-0.3	-0.3	14	69	-1.0	21.9	21.4
5	-0.89	22	comfortable	below	23.0, cool	23.2	-0.1	-0.1	23, draft risk	83	-0.9	21.9	21.4
6	-0.71	16	comfortable	below	22.8, cool	23.3	-0.1	-0.1	14	69	-0.9	21.9	21.4

Table L135 : Lecture Hall C (Outputs from ASHRAE Thermal Comfort Program)

Point	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
1	-0.83	20	comfortable	below	23.0, cool	23.1	-0.1	-0.1	24, draft risk	89	-0.7	21.9	21.8
2	-0.43	9	comfortable	in	22.9, cool	23.2	-0.1	-0.1	13	69	-0.6	21.9	22.0
3	-0.73	16	comfortable	below	23.0, cool	22.9	-0.2	-0.2	12	69	-0.4	21.9	22.3
4	-0.12	5	comfortable	in	22.9, cool	24.0	0	0	15	76	-0.5	21.9	22.2
5	-0.94	23	comfortable	below	22.9, cool	21.1	-0.2	-0.2	16, draft risk	76	-0.6	21.9	21.9
6	-0.92	23	comfortable	below	22.9, cool	22.7	-0.2	-0.2	28, draft risk	97	-0.6	21.9	21.9

Table L136 : Lecture Hall D (Outputs from ASHRAE Thermal Comfort Program)

Point	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
1	-1.16	33	comfortable	below	22.0, cool	21.8	-0.2	-0.2	13	81	-0.5	21.9	22.3
2	-1.19	35	comfortable	below	22.1, cool	22.0	-0.2	-0.2	16, draft risk	82	-0.8	21.9	21.9
3	-0.92	23	comfortable	below	22.2, cool	22.7	-0.2	-0.2	16, draft risk	81	-0.7	21.9	22.0
4	-1.04	28	comfortable	below	22.1, cool	21.9	-0.2	-0.2	12	77	-0.5	21.9	22.4
5	-1.17	34	comfortable	below	22.3, cool	22.1	-0.2	-0.2	28, draft risk	100	-0.8	21.9	21.9
6	-1.17	34	comfortable	below	22.2, cool	21.7	-0.2	-0.2	20, draft risk	89	-0.8	21.9	21.8

Table L137 : Lecture Hall E (Outputs from ASHRAE Thermal Comfort Program)

Point	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
1	-1.04	28	comfortable	below	22.5, cool	22.8	-0.2	-0.2	22, draft risk	88	-0.9	21.9	21.6
2	-1.14	33	comfortable	below	22.3, cool	22.3	-0.2	-0.2	26, draft risk	96	-0.9	21.9	21.7
3	-1.10	31	comfortable	below	22.3, cool	22.4	-0.2	-0.2	24, draft risk	94	-0.8	21.9	21.8
4	-1.25	38	comfortable	below	22.4, cool	22.1	-0.2	-0.2	24, draft risk	91	-0.9	21.9	21.6
5	-0.56	12	comfortable	below	22.4, cool	23.2	-0.1	-0.1	23, draft risk	91	-0.9	21.9	21.7
6	-1.13	32	comfortable	below	22.3, cool	22.2	-0.2	-0.2	16, draft risk	76	-1.0	21.9	21.4

Table L138 : Lecture Hall F
(Outputs from ASHRAE Thermal Comfort Program)

Point	PMV	PPD (%)	Feeling	ISO	ET* (°C)	SET* (°C)	TSENS	DISC	PD (%)	PS (%)	TS	T.neutral (Humphreys)	T.neutral (Auliciems)
1	0.51	10	comfortable	above	26.0	26.8	0.3	0.4	10	31, not enough air movement	0	21.9	23.1
2	0.30	7	comfortable	in	25.8	26.4	0.1	0.2	10	33, not enough air movement	0	21.9	23.1
3	0.05	5	comfortable	in	25.4	25.2	0	0	14	49, not enough air movement	0.1	21.9	23.3
4	0.10	5	comfortable	in	25.4, too humid	24.8	0	0	10	37, not enough air movement	0.2	21.9	23.5
5	0.44	9	comfortable	in	25.6, too humid	26.5	0.2	0.3	10	37, not enough air movement	0.2	21.9	23.5
6	0.00	5	comfortable	in	25.3	24.5	0	0	10	38,not enough air movement	0.2	21.9	23.5

Appendix M : Graphs of actual mean vote versus operative temperature for lecture halls

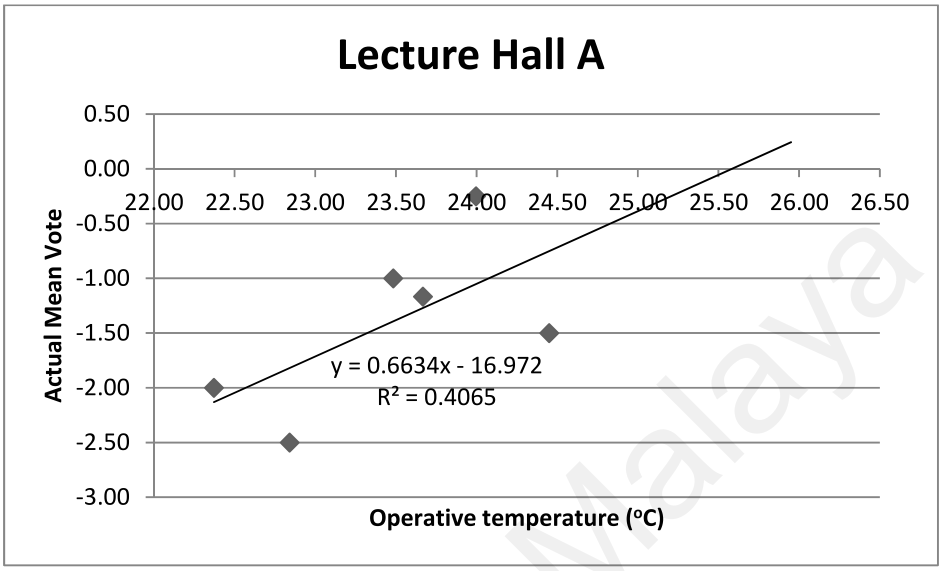

Figure M1 : Graph of AMV vs T_{op} for Lecture Hall A.

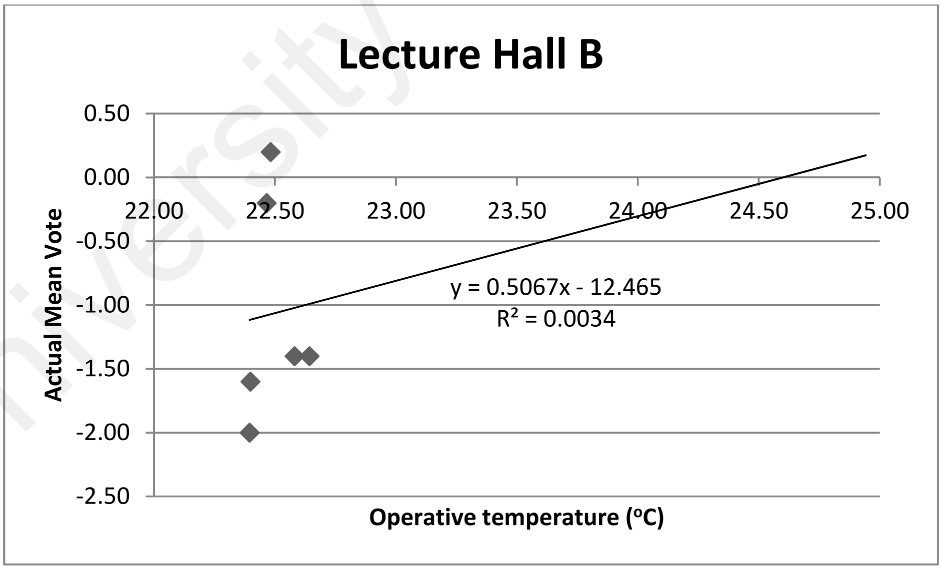

Figure M2 : Graph of AMV vs T_{op} for Lecture Hall B.

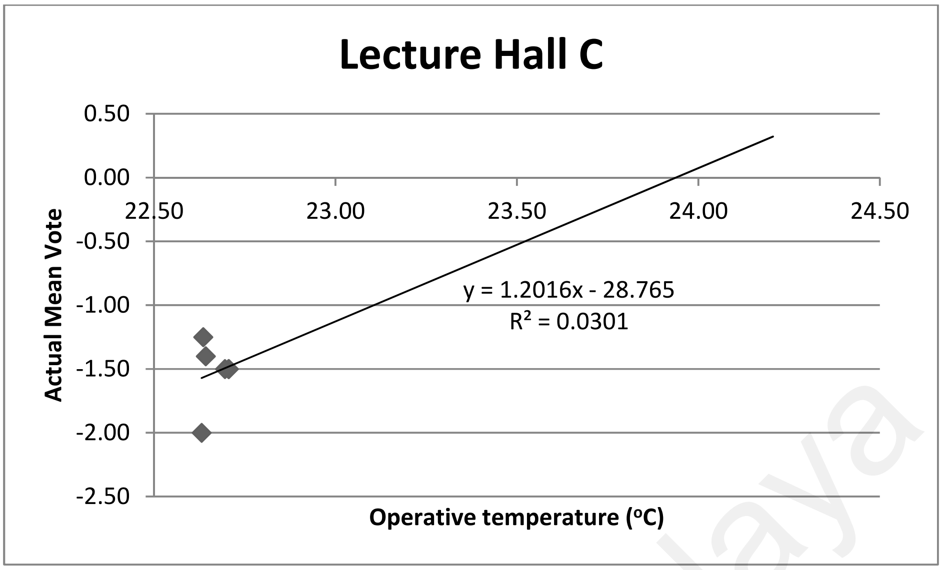

Figure M3 : Graph of AMV vs T_{op} for Lecture Hall C.

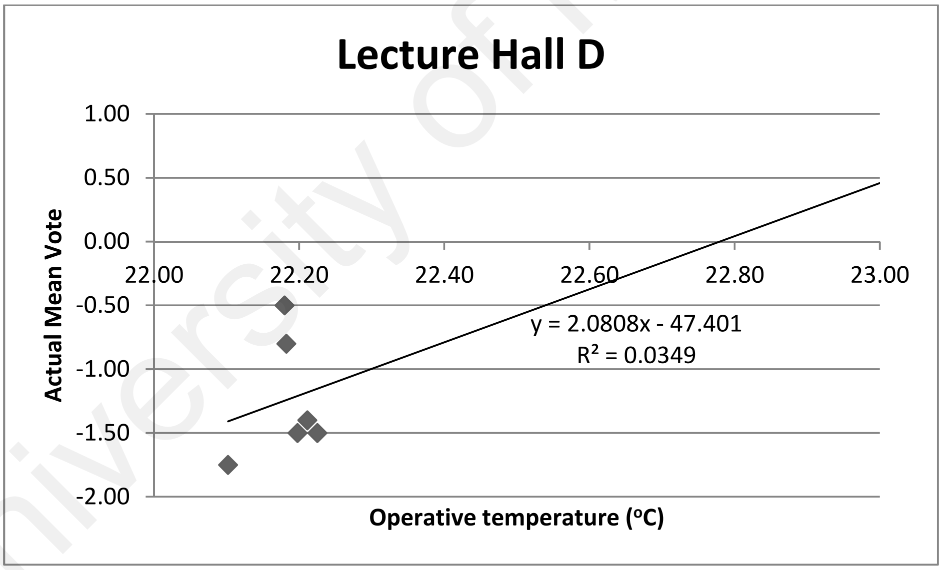

Figure M4 : Graph of AMV vs T_{op} for Lecture Hall D.

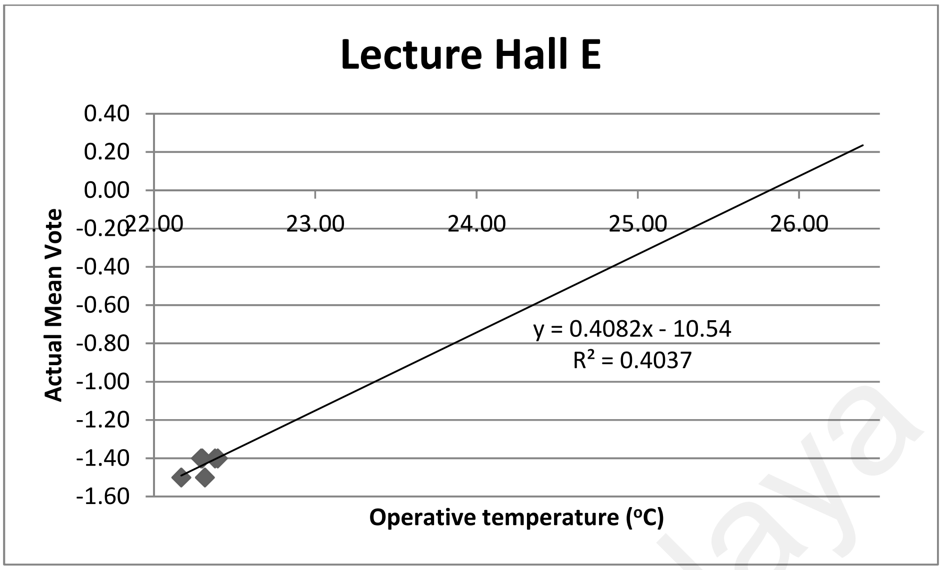

Figure M5 : Graph of AMV vs T_{op} for Lecture Hall E.

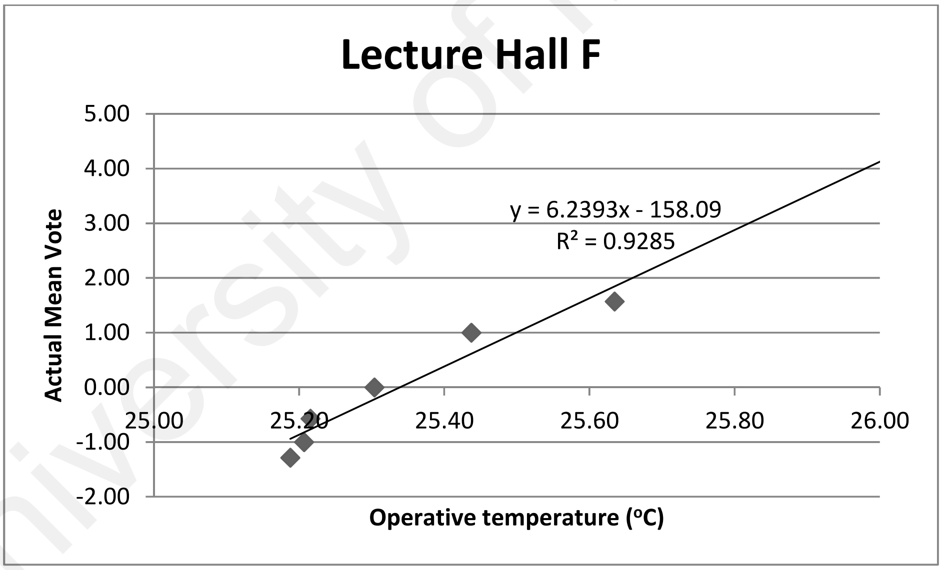

Figure M6 : Graph of AMV vs T_{op} for Lecture Hall F.

Appendix N : Residual analysis for lecture halls

No.	Explanatory variable, T_{out} (°C)	Response variable, T_n (°C)	Fitted value, T_n (°C)	Residual, e = Response variable - Fitted value
1	33.02	25.58	25.57	0.02
2	26.30	24.60	23.72	0.88
3	26.70	23.94	23.83	0.11
4	26.68	22.78	23.82	-1.04
5	33.90	25.82	25.81	0.01
6	32.08	25.34	25.31	0.03

Appendix O : Bias uncertainty analysis for lecture halls

Table O1 : Bias uncertainty analysis for Lecture Hall A.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.14	24.0	24.0	51.2	33.1
2	0.24	24.3	22.1	48.5	33.1
3	0.21	23.6	21.2	47.4	33.0
4	0.23	23.3	19.7	46.0	33.0
5	0.21	22.7	19.1	46.5	33.0
6	0.16	22.5	19.1	46.4	32.9
Average	0.20	23.4	20.8	47.7	33.0
Maximum	0.24	24.3	24.0	51.2	33.1
Minimum	0.14	22.5	19.1	46.0	32.9
Count	6	6	6	6	6
Bias Uncertainty	0.018	0.30	0.82	0.86	0.03
Error (%)	8.96	1.28	3.92	1.81	0.10

Table O2 : Bias uncertainty analysis for Lecture Hall B.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.22	22.4	21.3	61.8	26.4
2	0.12	22.5	21.4	62.5	26.3
3	0.17	22.6	21.0	62.6	26.2
4	0.10	22.6	20.9	63.1	26.2
5	0.16	22.7	21.0	62.4	26.3
6	0.10	22.7	21.0	63.0	26.4
Average	0.15	22.6	21.1	62.6	26.3
Maximum	0.22	22.7	21.4	63.1	26.4
Minimum	0.10	22.4	20.9	61.8	26.2
Count	6	6	6	6	6
Bias Uncertainty	0.020	0.05	0.08	0.23	0.03
Error (%)	13.79	0.22	0.36	0.36	0.13

Table O3 : Bias uncertainty analysis for Lecture Hall C.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.18	22.7	21.9	69.8	26.6
2	0.10	22.7	22.2	68.0	26.7
3	0.10	22.7	22.8	68.8	26.8
4	0.12	22.7	22.7	67.1	26.8
5	0.12	22.7	22.1	69.6	26.7
6	0.21	22.6	22.0	69.7	26.6
Average	0.14	22.7	22.3	68.8	26.7
Maximum	0.21	22.7	22.8	69.8	26.8
Minimum	0.10	22.6	21.9	67.1	26.6
Count	6	6	6	6	6
Bias Uncertainty	0.018	0.02	0.14	0.45	0.03
Error (%)	13.25	0.07	0.64	0.66	0.12

Table O4 : Bias uncertainty analysis for Lecture Hall D.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.11	22.1	22.9	49.1	26.8
2	0.12	22.1	22.1	47.4	26.6
3	0.12	22.2	22.2	48.2	26.6
4	0.10	22.1	23.2	48.5	26.8
5	0.21	22.2	22.0	49.9	26.7
6	0.15	22.2	21.8	48.5	26.6
Average	0.13	22.2	22.3	48.6	26.7
Maximum	0.21	22.2	23.2	49.9	26.8
Minimum	0.10	22.1	21.8	47.4	26.6
Count	6	6	6	6	6
Bias Uncertainty	0.018	0.02	0.23	0.42	0.03
Error (%)	13.39	0.08	1.04	0.87	0.12

Table O5 : Bias uncertainty analysis for Lecture Hall E.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.16	22.4	21.4	48.1	33.9
2	0.19	22.3	21.6	48.2	33.9
3	0.18	22.3	21.8	47.7	34.0
4	0.17	22.3	21.4	48.5	33.9
5	0.17	22.4	21.6	49.0	33.9
6	0.11	22.3	21.0	50.7	33.8
Average	0.16	22.3	21.4	48.7	33.9
Maximum	0.19	22.4	21.8	50.7	34.0
Minimum	0.11	22.3	21.0	47.7	33.8
Count	6	6	6	6	6
Bias Uncertainty	0.013	0.02	0.13	0.50	0.03
Error (%)	8.12	0.07	0.60	1.02	0.10

Table O6 : Bias uncertainty analysis for Lecture Hall F.

Point	V (m/s)	T_{globe} (^oC)	T_{air} (^oC)	RH (%)	T_{out} (^oC)
1	0.10	25.8	24.6	61.4	32.0
2	0.09	25.6	24.6	61.8	32.0
3	0.14	25.2	25.0	63.4	32.1
4	0.10	25.2	25.3	63.8	32.1
5	0.09	25.3	25.3	62.1	32.2
6	0.09	25.2	25.3	61.5	32.1
Average	0.10	25.4	25.0	62.3	32.1
Maximum	0.14	25.8	25.3	63.8	32.2
Minimum	0.09	25.2	24.6	61.4	32.0
Count	6	6	6	6	6
Bias Uncertainty	0.008	0.10	0.13	0.40	0.03
Error (%)	8.37	0.39	0.50	0.65	0.10

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