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PLAZAS ADJACENT TO TALL BUILDINGS: A THERMAL COMFORT REFUGE IN HOT HUMID URBAN SETTING

Noor Hanita Abdul Majid, PhD
Department of Building Technology and Engineering
Kulliyah of Architecture and Environmental Design
International Islamic University of Malaysia
Jalan Gombak, Kuala Lumpur
e-mail: ciknit@hotmail.com

Abstract

Comfortable outdoor spaces are important contributors to sustainable urban design. These thermally comfortable outdoor spaces potentially reduce the needs of providing internal public areas such as atrium lobbies, which in turn can contribute to energy conservation. Plazas adjacent to tall buildings, in this instance are one of the many types of outdoor spaces that could provide places of refuge in the hot humid urban areas. The scenario of Kuala Lumpur and micro-climate of the plazas adjacent to tall buildings are presented in this paper. As one of the fastest developing city in the South-East Asia region, Kuala Lumpur experiences the challenges of providing for the physical and social needs. Plazas adjacent to tall buildings that are 'habitable' could be the answer to these needs. This paper also touches on issues of space utilization and discusses the cases of local and overseas. Cultural and social effects on space utilization at the urban plazas are described to indicate the situation. These aspects are also discussed in conjunction to scientific evidences from thermal comfort studies at the plazas adjacent to tall buildings in Kuala Lumpur.

INTRODUCTION

A better understanding on the thermal comfort conditions can help in providing a thermal comfort refuge in the hot humid urban setting. Plazas built adjacent to tall buildings (PATB) in Kuala Lumpur are attempts towards providing outdoor spaces for the urban population. These plazas are alternatives for air-conditioned indoor spaces, which are becoming more common locally. Despite the hot humid conditions, the PATBs could be a potential solution in providing for public outdoor areas if proper provisions are taken to improve the micro-climatic conditions. These outdoor solutions could also be important contributors to sustainable urban design. Field experiments and behaviour observation exercise were carried out to investigate the significance of providing shaded areas with suitable socio-cultural considerations to encourage utilisation of the plazas adjacent to tall buildings.

CASE STUDIES DESCRIPTION

Climatic Context

The climate of Kuala Lumpur (latitude 3° 08'N, longitude 101° 44'E) is generally hot and humid all year long. Temperatures are high with little variations throughout the day. The hottest periods of the year are during the months of March to May. The Meteorological Service Station of Kuala Lumpur recorded that humidity ranges between 55% to 99% during the day. In Kuala Lumpur, the mean surface wind speed is rather low with variations between 1.1 to 1.6 m/s (mean surface wind speed from 1974-1998).

The Plazas Adjacent to Tall Buildings in Kuala Lumpur (PATBs)

The term PATB as defined by Noor Hanita¹ refers to open spaces of whatever shape that is completely or partially open to the sky, and designed to function simultaneously with a tall building and to be utilised as passive or active space. For the purpose of the study, five PATBs in the city of Kuala Lumpur have been chosen as the site for the field experiments. The PATBs are Daya Bumi Plaza (DBP), Selangor Dredging Plaza (SDP), Menara Tun Razak Plaza (MTRP), Public Bank Plaza (PBP) and Aetna Universal Plaza (AUP).

SURVEYS

Surveys in this study refer to the Thermal Comfort Field Experiment and the Observation Exercise. Both surveys are conducted to investigate the relationship between the thermal comfort conditions and the utilisation patterns at the PATBs.

Thermal Comfort Field Experiments

The thermal comfort field experiments can be divided into two parts. First is Experiment A where the thermal comfort data are collected in PMV values. The PMV measurements were taken using the Thermal Comfort Meter (B&K Type 1212). Experiment A was conducted for five days. Detailed procedures on the experiment is described in Md Najib & Noor Hanita². The duration of the data collection was approximately eight hours of daytime at each PATB. The climate conditions during the experiments are shown in Table 1.

Second is Experiment B which was conducted for the purpose of evaluating human response on the conditions at the PATBs (Md Najib & Noor Hanita³). Eight (8) human subjects consisting of four (4) female and four (4) male fully acclimatised college-aged Malay students were involved in this experiment. A clothing insulation value of 0.6 was adopted for male and female subjects. The human subjects were dressed in common daily attire for Malaysian. The insulation value was estimated from the Tables of Garment Insulation Value by McCullough and Jones in ASHRAE⁴.

Table 1: Climatic Parameters at the PATBs

Climatic Parameters at the PATBs	DBP	SDP	MTRP	PBP	AUP
Air Temperature (C)	24-40	29-41	28-38	27-42	26-40
Air Velocity (m/s)	0.1-3.5	0.1-1.8	0.1-2.7	0.2-2.6	0.1-2.5
Relative Humidity (%)	34-79	40-79	31-88	22-88	29-77
Metabolic Rate (met)	1.0	1.0	1.0	1.0	1.0
Clothing Insulation (Icl)	0.6	0.6	0.6	0.6	0.6

The human subjects voted on the 7-points ASHRAE Thermal Sensation Scale* simultaneously with measurement of PMV from the Thermal Comfort Meter at half-hour interval. A correlation test was performed on the results of PMV and TSV. The correlation results were labelled as modified PMV or PMVm. The results showed that the PMV measurement has over-predicted the TSV from the human subjects (Md Najib & Noor Hanita⁵). This finding was in accordance to the findings of Abdul Malik⁶ from a thermal chamber experiments on Malaysian. The difference in thermal sensation might be attributed to the acclimatisation of the human subjects to the outdoor climate of the hot humid climate.

The PMVm was applied to the measurement of PMV from the Thermal Comfort Meter recorded at each PATB. The results showed that the shaded conditions at the PATBs enjoyed comfortable outdoor conditions at certain parts of the daytime. The shaded conditions can be achieved at the PATBs through proper orientation and geometry of the open plaza and the adjacent tall buildings. Noor Hanita⁷ described the importance of orientation and geometry in accomplishing shaded conditions. These results explained the intensity of human activities at the PATBs at certain hours of the day as indicated by the observation exercise.

Observation Exercise

Observations were done to identify the activities that are common at all PATBs. Activities that have the highest record of occurrence were walking/ strolling, sitting, reading, eating and sleeping. Besides walking/ strolling other activities fall under the sedentary activities. Marcus & Cooper⁸ also agreed that modern plazas are utilised as places of sitting, standing, walking with combination with eating, reading, watching and listening. It was also recorded that most activities at the PATBs took place at the shaded areas. Suitable to the hot humid climate, with sunshine that is accompanied by radiation, the PATBs users are inclined to seek for the shaded areas.

The Physical and Social Challenges

Three most important factors that governed the utilisation of outdoor spaces, in this instance PATBs, are thermal comfort, environment simulation and culture. Several studies (Cadima⁹)(Rowe¹⁰)(Nikolopolou et. al.¹¹) have noted that at urban outdoor spaces, people tend to either seek for or shy away from the sun. In temperate climate, people seek for comfort by sitting under the sun and feel the warm sun rays, while in the hot humid climate people tend to utilise fully the shaded areas that are achieved either by the geometry and orientation of adjacent building or surrounding vegetation (Figure 1).

The existence of environmental simulation encourages the PATBs utilisation. Environmental simulations may be in form of human activities or natural and aesthetic features. The observation done at the PATBs indicated that people have been one of the most important stimulator at PATBs. Utilisation at the PATBs will increase rapidly given a few users as a start. Besides people, natural and aesthetic features such as water and landscape also encourage utilisation at the PATBs.

Besides the physical features, culture also played an important role in determining the utilisation of the outdoor areas, in particular the PATBs. The evidence from Western countries showed that outdoor spaces are heavily utilised if the climate permits. In this part of the world, besides the thermal factors, the Malay cultural and social factors also played a substantial role. As culture is the unique human response to environment and an attempt to answer to both physical and spiritual needs, the utilisation of the outdoor spaces varies according to culture of the human beings. For example, while people watching might be an accepted and most frequent activity in the open plazas, this human behavioural aspect is not universally acceptable. It was found from the observation exercise that people tend to occupy the more private or secluded sections of the PATBs (Figure 2). Governed by cultural and religious values, people watching or even sitting out in the open is a new behavioural phenomenon that is still growing in Malaysia.

Nevertheless, in this paper the PATB utilisation was purely done by researcher's observation and did not include users opinion surveys.

CONCLUSION

The need for thermal refuge at the urban areas has always been there. However, the affecting factors need to be adhered to in order to provide successful outdoor areas, in particular PATBs. The study has found that PATBs in Kuala Lumpur were utilised. The thermal comfort field experiments and the observation studies have indicated that the urban population in the hot humid climate has the inclination to use these outdoor areas provided that the PATBs were properly designed to suit the climatic and social conditions. Successful outdoor spaces can benefit the adjacent buildings by attracting economically profitable activities to the adjacent buildings and the socio-cultural image of the city

NOTES AND REFERENCES

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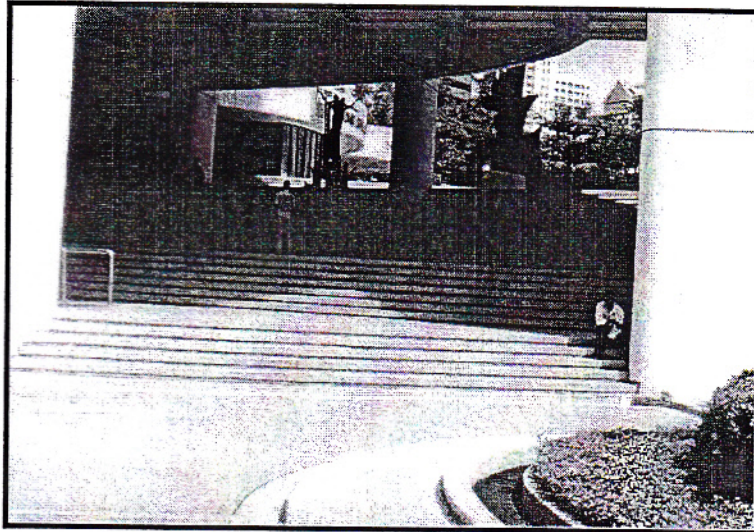


Figure 1: People Utilising the Shaded Areas Underneath
the Tall Building at Aetna Universal Plaza

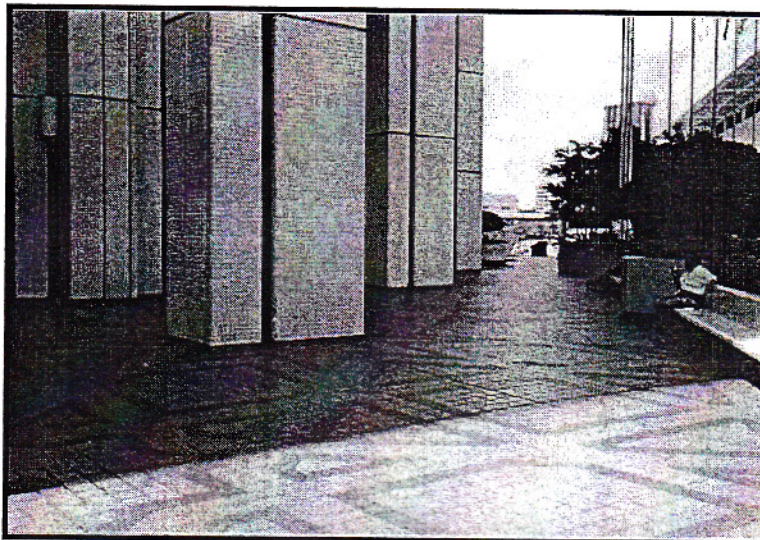


Figure 2: Utilisation Occurs at a Secluded Section at the
Daya Bumi Plaza