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# Parametric Analysis of the Thermal Comfort Conditions of Unshaded Courtyards in the Tropical Context of Kuala Lumpur

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## ABSTRACT

In recent years, there has been a growing interest in exploring the impacts of urban built environments and their design configurations on outdoor thermal comfort conditions, particularly in the tropical contexts. Urban built environments and their interrelations with micro-climatic variations are considered as significant parameters for improving the experience and overall satisfaction of users in cities. Moving forward, the rapid urbanization and current construction developments in metropolitan cities, including Kuala Lumpur, have increased the need to create more thermally comfortable outdoor environments for recreational activities. As a result, several scholarly studies have drawn attention to the crucial necessity for a consistent collaboration between urban designers, architects and urban climate scientists into account the outdoor thermal comfort principles in order to address the urban greening targets. From another viewpoint, recent studies present the great potentials of courtyards towards ameliorating the thermal performance of urban built environments. Accordingly, this study explores the thermal performance characteristics and outdoor thermal comfort conditions of selected courtyards in the University of Malaya (UM) in Kuala Lumpur. The study concentrates on physiologically equivalent temperature (PET) using RayMan software as an appropriate outdoor thermal comfort index to evaluate the impacts of versatile heat mitigation strategies and design configurations on PET variations. Findings reveal that while courtyards encompass substantial potentials to be utilized as ...

**Keywords:** Sustainability; Outdoor Thermal Comfort; Courtyards; Heat Mitigation; Hot and Humid Climate

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## PARAMETRIC ANALYSIS OF THE THERMAL COMFORT CONDITIONS OF UNSHADED COURTYARDS IN THE TROPICAL CONTEXT OF KUALA LUMPUR

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### Abstract

*In recent years, there has been a growing interest in exploring the impacts of urban built environments and their design configurations on outdoor thermal comfort conditions, particularly in the tropical contexts. Urban built environments and their interrelations with micro-climatic variations are considered as significant parameters for improving the experience and overall satisfaction of users in cities. Moving forward, the rapid urbanization and current construction developments in metropolitan cities, including Kuala Lumpur, have increased the need to create more thermally comfortable outdoor environments for recreational activities and beyond. As a result, several scholarly studies have drawn attention to the crucial necessity for a consistent collaboration between urban designers, architects and urban climate scientists to take into account the outdoor thermal comfort principles in order to address the urban greening targets. From another viewpoint, recent studies present the great potentials of courtyards towards ameliorating the thermal performance of urban built environments. Accordingly, this study explores the thermal performance characteristics and outdoor thermal comfort conditions of selected courtyards in the University of Malaya (UM) city campus in Kuala Lumpur. The study concentrates on physiologically equivalent temperature (PET) using RayMan software as an appropriate outdoor thermal comfort index to evaluate the impacts of versatile heat mitigation strategies and design configurations on PET variations. Findings reveal that while courtyards encompass substantial potentials to be utilized as micro-climatic modifiers, they can have extremely poor performance if they are not efficiently designed and constructed based on climate responsive approaches. Furthermore, the findings demonstrate that the studied courtyards generally failed to provide thermally pleasant outdoor spaces for their occupants throughout the entire period of field measurements as indicated by their high PET values. Finally, it can be concluded that during the design of outdoor spaces, including courtyards, in the tropics, more attention should be paid to the vital role of heat mitigation strategies.*

**Keywords:** Sustainability, Outdoor Thermal Comfort, Courtyards, Heat Mitigation, Hot and Humid Climate