A STUDY ON INDOOR THERMAL COMFORT IN CONDOMINIUM HOUSING SCHEMES WITH SPECIAL REFERENCE TO ELAPITIWELA HOUSING SCHEME WELISARA, RAGAMA

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Introduction

Indoor thermal comfort is a crucial consideration in building design, as it directly impacts the satisfaction and productivity of building occupants. Ensuring that residents can maintain a comfortable living environment within their budget is particularly important in the context of affordable housing. Energy costs, especially those related to cooling, constitute a significant expense for buildings in Sri Lanka. By employing passive methods to achieve optimal indoor thermal comfort, it is possible to reduce energy consumption and, consequently, the overall cost of housing. This research aims to analyse the indoor thermal comfort of condominium housing, with a specific reference to how thermal comfort is influenced by the factors such as orientation, apartment height, surrounding vegetation, and proximity to other buildings. Elapitiwela Housing Scheme in Welisara, Ragama was chosen as the focus of this study, based on its unique characteristics that make it an ideal case for investigating indoor thermal comfort in condominium housing.

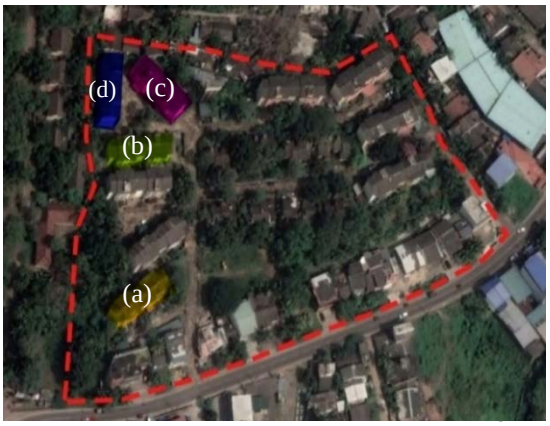

Figure 1: Scheme layout with orientation

The scheme comprises ten identical condominium blocks, each featuring distinct orientations, including north-south, northeast-southwest, northwest-southeast, and others. This arrangement provides a diverse range of building orientations, allowing for a comprehensive examination of the impact of orientation on thermal comfort. Valuable insights can be gained through this study, into the dynamics of indoor thermal comfort and its potential implications for affordable housing design.

Methodology

The methodology for this research involved a multi-step approach. Firstly, suitable housing schemes in the western province were identified through a survey, considering factors such as climate and contextual surroundings. Data gathering focused on different apartment orientations and heights within the selected housing schemes, with an emphasis on understanding how surrounding factors like vegetation and neighbouring buildings influenced shade and wind patterns. A questionnaire was designed and administered to collect data on occupants' perceptions of thermal comfort, covering aspects such as comfort during the day and night, ventilation preferences, and methods used to control thermal comfort. The collected data were then compared to assess indoor thermal comfort levels, considering factors like orientation, height, ventilation, and shade. The findings were summarized and discussed, highlighting the relationships between these factors. This methodology provides valuable insights into the complexities of indoor thermal comfort and contributes to the ongoing discourse on housing design considerations in relation to occupant comfort.

Results and Discussion

The study collected questionnaire responses from 46 units of the condominium housing scheme. Results showed that out of the 46 responses, only a small number of apartments reported being thermally comfortable during the day and night. Additionally, perceived thermal levels at night were generally lower compared to daytime levels, as expected. Notably, the building on the northwest-southeast axis had the lowest thermal discomfort levels, while the building on the northeast-southwest axis had the highest.

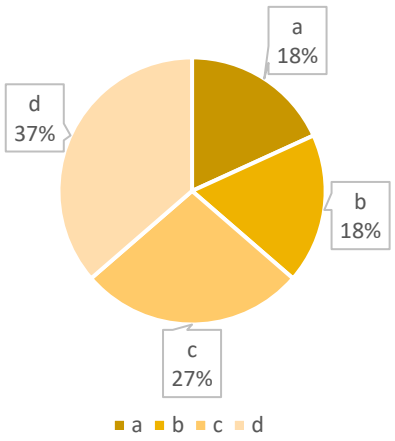

Figure 2: Responses recorded as thermally comfortable during the day sorted by orientation.

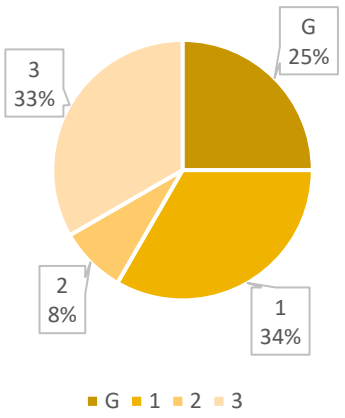

Figure 3: Responses recorded as thermally comfortable during the day sorted by floor height.

Ground floor and first floor apartments generally had lower thermal comfort compared to higher floors. 26 apartments reported that they receive adequate natural ventilation, and 15 apartments reported that they received adequate shade. Most residents used fans for thermal comfort control, with a few using air conditioning. Overall, the results showed almost similar patterns across the buildings, with minor variations observed. These findings emphasize the importance of considering factors such as orientation, floor height, ventilation, shade, and active thermal comfort control in condominium housing design to enhance occupants' satisfaction.

Conclusion

In conclusion, this study investigated indoor thermal comfort in condominium housing, considering factors such as orientation, floor height, ventilation, and shade. Out of the 46 apartments surveyed, only 11 reported being thermally comfortable during the day, and 13 at night. Surprisingly, the building with a north-south orientation, typically considered less favourable, had the highest number of responses indicating thermal comfort during the day, potentially due to shade and natural ventilation. The ground floor and first floor showed more comfortable thermal comfort levels compared to higher floors, likely due to shade and protection from the roof. Residents' perception of thermal comfort varied, with individuals having different preferences and adapting to change clothing and activity patterns. Through these findings we can suggest several design solutions to enhance occupant satisfaction and energy efficiency. These solutions include incorporating effective shading devices, optimizing building orientation for natural ventilation, using high-performance insulation materials, integrating smart building systems, and educating residents about energy-efficient practices. By implementing these solutions, architects and developers can create condominium housing schemes that prioritize thermal comfort, reduce energy consumption, and provide affordable and sustainable living environments for residents.

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