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EFFECT OF ROOFING ON THE THERMAL COMFORT IN DOMESTIC BUILDINGS IN SRI LANKA

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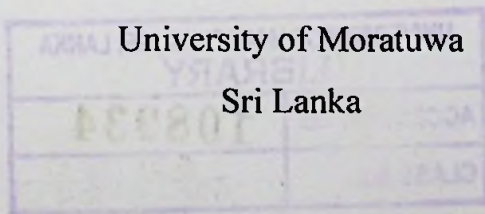
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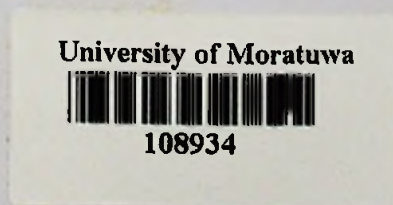
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DECLARATION OF THE CANDIDATE AND SUPERVISOR

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ABSTRACT

This study aimed to investigate the indoor thermal performance of different roofing and ceiling alternatives and their configurations used for residential buildings in Sri Lanka. In this regard, a basic residential building was selected as the reference case.

Five roofing and two ceiling materials were used and combinations of roofing/ceiling types were obtained to investigate the relative effect on the indoor temperature fluctuations and energy use. Both 2-pitched and 4-pitched roof designs were selected and the buildings were aligned for two orientations; east-west and north-south. The two-pitched bare roof (no-ceiling) constructed with a commonly used old cement fiber sheet (asbestos) material was selected as the reference case. The computer software tool, DEROB-LTH (version 99.02) was used to model the building and evaluate the cooling energy use and the indoor air temperatures. These parameters were evaluated hourly, daily and monthly basis for three different months of the year 2011.

The simulation results have shown that there is a noticeable difference in cooling energy use and indoor air temperature with the changes in roofing and ceiling materials as well as with different roof configurations. The results suggest a positive conclusion towards the feasibility of using burnt clay calicut tiles with wooden plank flat suspended ceiling, it was further shown that the common roofing material used in the Sri Lankan residential building industry. Asbestos sheet is not feasible in terms of energy cost and indoor thermal performance.

Finally, an economic analysis / cost-benefit analysis was performed in order to investigate the economic viability of applying different roofing/ceiling combinations and the results indicate that most of the designs are feasible in terms of the cooling energy use and additional expenditure incurred. Simple pay back periods were less than 4 years in most cases. The results also elaborated that even though new calicut tile roof design is expensive, it is worth paying for considering the climate of Sri Lanka. It is suggested that through experimental validation and modeling, these results could be further validated to enhance the accuracy of the output obtained from DROB-LTH.

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LIST OF ABBREVIATIONS

CC	-	Conventional Calicut
E-S	-	East-South
NA	-	New Asbestos
NC	-	New Calicut
N-S	-	North-South
OA	-	Old Asbestos
PA	-	Painted asbestos
S-E	-	South-East