

Enhancing thermal performance and energy saving through apartment buildings roofs in
Palestine: Dura context

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ABSTRACT

Energy consumption in residential buildings in Palestine is in high levels. On the other hand, there are significant opportunities to improve energy consumption efficiency through enhancing building envelopes. Building envelopes play a pivotal role in the effective regulation of thermal comfort and energy conservation by serving as a barrier between the internal and external environments, and controlling the heat flow between them. The roof is a main part of the building envelope, and in addition to the external walls, it acts as a main barrier against the heat gain in hot summer and heat loss during winter. This thesis seeks to provide an extensive improvement of the thermal performance of common construction practices in Dura in terms of roof slab components. This thesis provides a comparative analysis of the thermal performance and energy consumption of the common roof slab with other less common or suggested and recommended patterns. In addition, the study provides an analysis of multiple interventions for different roof slab construction patterns with different considerations including the type and thickness of block used, different insulation materials and their thickness. Research tools such as survey sheets, field visits, and simulations using the (Design-builder) program are used to represent a standard apartment model in Dura, to come up with a set of directives for architects and decision makers that serve the design and implementation stages around the correct selection of the construction pattern, block, and type of insulators used, which enhance the internal environment and reduce energy levels consumed for heating and cooling. The results presented showed that the use of polystyrene blocks or itong blocks as substitutes for hollow concrete blocks in ribbed slabs is feasible compared to other blocks, proving the highest thermal improvement and reasonable energy saving ratio, making it a viable solution. The study also confirmed energy savings of up to 43% in heating loads for ribbed slabs using polystyrene or itong blocks, with savings reaching 44% for ribbed plates

with hollow concrete blocks, when polyurethane foam was used as the most effective insulation for various thoughtful building patterns, compared to the base scenario.

Keyword: Thermal comfort, Thermal Performance, Thermal Insulation, Roof Insulation, Roof slabs, Insulation Materials