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Thermal Performance Analysis of Hassan Fathy's Traditional and Hybrid Building Systems: The Case of Dar al-Islam Village

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ABSTRACT

In the field of architecture, the fact that the interaction between traditional buildings and the climate is rooted in deep empirical knowledge makes the evaluation of bioclimatic design strategies through these systems a valid methodological approach. In this context, Egyptian architect Hassan Fathy (1900–1989) is one of the key architects who, while addressing the spatial and structural challenges of his era on a functional basis, demonstrated—both theoretically and practically—the necessity of establishing a sustainable relationship between architecture and climate through traditional construction methods. This study aims to conduct a comparative analysis of the building envelope solutions in the structural system created using traditional adobe building materials—as uniquely applied by Hassan Fathy in his rural projects in Upper Egypt—and the building envelope of the adapted adobe structural system implemented in the Dar al-Islam project in the U.S. state of New Mexico in 1980. The study focuses on the changes the building envelope undergoes in accordance with legal regulations and climatic necessities during the process of adapting traditional architectural practices to a different geography. The scope of the research involves examining the adaptations to the building envelope necessitated by American building codes and regional harsh winter conditions during the process of transferring traditional architecture to a different geographical context. In this context, the central research question is to elucidate how the differences between this newly mandated building envelope design and the original construction system impact the building's energy efficiency and bioclimatic performance.

As part of the research methodology, two different building envelope scenarios were analyzed comparatively using computational building energy simulations. The first scenario, designed as a reference model, reflects Hassan Fathy's original design practice, which incorporates the traditional Nubian-style adobe roofing system and passive climate control strategies. The second scenario models a hybrid adobe envelope that has been revised in accordance with regulations mandated by local building authorities for the Dar al-Islam project; it incorporates industrial components such as a reinforced concrete foundation, cement-based exterior plaster, polyurethane foam insulation, and electric heating networks integrated into structural elements (floors and roof). The data obtained from the research quantitatively demonstrate

the differences in thermal performance between the reference model and the adapted envelope scenario. Through this analysis, the study examines how the integration of traditional systems with industrial components alters the building's passive bioclimatic potential and shapes the need for active conditioning systems. In conclusion, the study offers an original contribution to the literature by objectively presenting the outcomes of hybridization—arising from the transfer of regional architectural practices to new geographies—within the context of sustainability parameters and holistic energy performance.

KEY WORDS:

Hassan Fathy, Dar Al-Islam Village, Building Envelope, Energy Simulation, Bioclimatic Performance