

Envelope Thermal Design Optimization of Buildings with Intermittent Occupancy

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ABSTRACT: Buildings with intermittent occupancy may not perform thermally the same as typical commercial and residential facilities. Thermal comfort requirements require careful envelope design coupled with the appropriate air-conditioning system operation strategies. One of the most prominent examples of such buildings is mosques. Mosques are usually occupied five intermittent times day and night all year round. Like any other building, they have to be mechanically air-conditioned to achieve the required thermal comfort for worshippers especially in harsh climatic regions. This paper describes the physical and operating characteristics typical for the intermittently occupied mosques as well as the results of the thermal optimization of a medium size mosque in the two hot-dry and hot-humid Saudi Arabian cities of Riyadh and Jeddah. The analysis utilizes a direct search optimization technique that is coupled to an hourly energy simulation program. Based on that, design guidelines are presented for the optimum thermal performance of mosques in these two cities in addition to other design and operating factors that need to be considered for mosques in general.

KEY WORDS: energy conservation, optimization, thermal design, intermittent operation, mosques, hot, hot-humid climate, Saudi Arabia.