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Urban Block Design's Impact on the Indoor Daylight Quality, Heating and Cooling Loads of Buildings in the Semi-Arid Regions: Duhok City in Kurdistan Region-Iraq as a Case Study

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Abstract : It has been proven that designing sustainable buildings starts from early stages of urban design. The design of urban blocks specifically, is considered as one of the pragmatic strategies of sustainable urbanism. There have been previous studies that focused on the impact of urban block design and regulation on the outdoor thermal comfort in the semi-arid regions. However, no studies have been found that concentrated on that impact on the internal behavior of buildings of those regions specifically the daylight quality and energy performance. Further, most studies on semi-arid regions are focusing only on the cooling load reduction, neglecting the heating load. The study has focused on two parameters of urban block distribution which are the block orientation and the surface-to-volume ratio with the consideration of both heating and cooling loads of buildings. In Duhok (a semi-arid city in Kurdistan region of Iraq), energy consumption and daylight quality of different types of residential blocks have been examined using dynamic simulation. The findings suggest that there is a considerable higher energy load for heating than cooling, contradicting many previous studies about these regions. The results also highlight that the orientation of urban blocks can vary the energy consumption to 8%. Regarding the surface-to-volume ratio (S/V), it was observed that after the twice enlargement of the S/V, the energy consumption increased 15%. Though, the study demonstrates as well that there are opportunities for reducing energy consumption with the increase of the S/V which contradicts many previous research on S/V impacts on energy consumption. These results can help to design urban blocks with the bigger S/V than existing blocks in the city which it can provide better indoor daylight and relatively similar energy consumption.

Keywords : blocke orienation, building energy consumption, urban block design, semi-arid regions, surfacet-to-volume ratio
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