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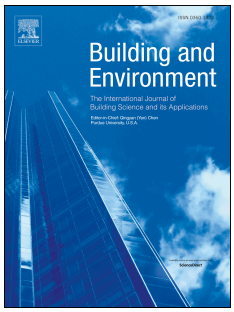

Defining thermal comfort boundaries for heating and cooling demand estimation in Iran's urban settlements

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Defining thermal comfort boundaries for heating and cooling demand estimation in Iran's urban settlements

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Abstract:

Iran has diverse climate variability, comfort boundaries for each geographic region must be defined in order to present current architectural design recommendations and proper mechanical systems design to meet building's heating and cooling energy demand. Therefore, two components of the temperature and relative humidity of 148 stations with the longest common statistical period of twenty years (1994 to 2014), which have been in daily scale were selected to calibrate and redefine the thermal boundary conditions in Iran. Givoni chart was used to define and visualize the bioclimatic conditions in buildings. The results of this study indicate that only 18% of the 148 stations days, falls in the thermal comfort bioclimatic conditions. After calibration of the base comfort temperature, we found that the upper threshold of this component varies from at least 22.62°C for Ardebil to 25.94°C for Dorudzan station and the low threshold of this component belongs to Ardebil with at least 20.13°C up to its maximum value with 22°C which belongs to Dorudzan. Spatial distribution of cooling and heating days show that their maximum threshold has been for cores in Northeastern half of Iran, Iran's Western half and some Central parts of Iran and the minimum threshold of these two components belongs to the beaches of north and south of the country. The findings present updated thermal comfort boundaries that can be used by architects, engineers and policy makers to achieve, in turn, more energy efficient homes and high quality indoor and outdoor living environments.

Keywords: Climate diversity, bioclimatic chart, heating and cooling degree days, weather stations, climate responsive design, Iran

1. Introduction

Building designers require accurate climate characterization and updated articulation of comfort boundary conditions for every project they design and build [1]. Controlling climatic conditions is one of the factors affecting human life, well-being and physical health. The essence of architectural design is to benefit from the favorite climate conditions in every project site using passive and bioclimatic design strategies to achieve thermal comfort with minimum use of active systems [2]. In most of the times, it is impossible to achieve summer and winter comfort in buildings using only passive and bioclimatic design measures. Therefore, mechanical engineers intervene to cover the cooling or heating demand periods using active system, such as heating and cooling system and mechanical