

The Impact of Climate Change on Typical Material Degradation Criteria over Timurid Historical Heritage

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Abstract : Understanding the ways in which climate change accelerates or slows down the process of material deterioration is the first step towards assessing adaptive approaches for the conservation of historical heritage. Analysis of the climate change effects on the degradation risk assessment parameters like freeze-thaw cycles and wind erosion is also a key parameter when considering mitigating actions. Due to the vulnerability of cultural heritage to climate change, the impact of this phenomenon on material degradation criteria with the focus on brick masonry walls in Timurid heritage, located in Iran, was studied. The Timurids were the final great dynasty to emerge from the Central Asian steppe. Through their patronage, the eastern Islamic world in northwestern of Iran, especially in Mashhad and Herat, became a prominent cultural center. Goharshad Mosque is a mosque in Mashhad of the Razavi Khorasan Province, Iran. It was built by order of Empress Goharshad, the wife of Shah Rukh of the Timurid dynasty in 1418 CE. Choosing an appropriate regional climate model was the first step. The outputs of two different climate model: the 'ALARO-0' and 'REMO,' were analyzed to find out which model is more adopted to the area. For validating the quality of the models, a comparison between model data and observations was done in 4 different climate zones in Iran for a period of 30 years. The impacts of the projected climate change were evaluated until 2100. To determine the material specification of Timurid bricks, standard brick samples from a Timurid mosque were studied. Determination of water absorption coefficient, defining the diffusion properties and determination of real density, and total porosity tests were performed to characterize the specifications of brick masonry walls, which is needed for running HAM-simulations. Results from the analysis showed that the threatening factors in each climate zone are almost different, but the most effective factor around Iran is the extreme temperature increase and erosion. In the north-western region of Iran, one of the key factors is wind erosion. In the north, rainfall erosion and mold growth risk are the key factors. In the north-eastern part, in which our case study is located, the important parameter is wind erosion.

Keywords : brick, climate change, degradation criteria, heritage, Timurid period

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