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About Predicting the Effect of Global Warming on RC. Structures in Zambia and Japan Due to Carbonation

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ABSTRACT

The problem of carbonation-induced corrosion has become a concern in recent times, especially in the 21st century, due to the increase in global temperatures and CO_2 concentration in the atmosphere posing a significant threat to the durability of RC. Structures worldwide, especially in inland tropical regions where carbonation is the most significant concrete degradation mechanism. Therefore, a study was conducted to predict the impact of global warming on the carbonation of RC structures in Lusaka, Zambia, and Tokyo, Japan. The Impact was estimated based on a carbonation meta-model that applies the analytic solution of Fick's 1st law using literature-based concrete mix design data and forecasted local ambient temperature and atmospheric CO_2 concentration data over a 100-year period with relative humidity assumed constant.

The results showed that coefficient values increased by over 40% which subsequently led to a significant reduction in corrosion initiation time of. more than 50 % based on an analysis of a 5cm concrete cover depth. Moreover, for the same water-cement ratio, Lusaka showed almost twice higher carbonation coefficient values and three times faster corrosion initiation time compared to Tokyo, mainly due to its higher temperature and low relative humidity. These findings indicate that RC. Structures in these cities are at risk of rapid deterioration due to global warming, especially in Lusaka, where they are more vulnerable. Therefore, it is vital to raise awareness about the risk of global warming on the carbonation of RC. Structures critically account for it in life cycle design and to further adopt preventive maintenance strategies to reduce the potential risks.

Keywords: RC. Structures, Carbonation coefficient, Corrosion initiation time, global warming, cover depth

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