

Effects of Climate Change on Structures: Analysis of Carbonation-Induced Corrosion in Reinforced Concrete Structures in Malta

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The various elements that are affecting the Earth's climate have brought climate change to the top of the priority list amongst scientists and policy-makers. Expected changes to local climatic conditions impact directly on the surrounding environment and potentially lead to changes in the degradation processes of building materials, affecting the durability and service life of infrastructures. The aim of this paper is to investigate the effects of future climate projections on concrete structures in Malta, in particular on carbonation-induced corrosion resulting from increasing temperatures and CO₂ concentrations. Thirteen reinforced concrete structures in Malta were chosen for a retrospective analysis in order to validate two carbonation depth prediction models. The validated prediction models were subsequently used to evaluate the varying climate change scenarios in order to determine the effects on concrete carbonation depth for several concrete grades. The age of the structures used for the retrospective analysis ranged from 10 to 60 years. The field data verified the validity of both prediction models for structures with carbonation depths less than 50mm. Although both models proved valid for the retrospective analysis, a difference was noted between the models with regards to the predicted carbonation depth in relation to different climatic scenarios. An increase in carbonation depth of up to 40% is being predicted, by 2070, when considering the worst case climatic scenario. The findings prove that climate change plays a major role on the carbonation depth of concrete, which in turn reduces the service life of concrete structures.