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Cost-Effectiveness of Climate Change Adaptation Strategies for Existing Coastal Reinforced Concrete Structures

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Abstract

Reinforced concrete (RC) structures are subjected to environmental actions that affect their performance, serviceability and safety. Among these actions, chloride ingress leads to corrosion initiation and its interaction with service loading could reduce its operational life. Experimental evidence indicates that chloride ingress is highly influenced by weather conditions in the surrounding environment. On the other hand, studies on global warming announce several changes in climate that could affect RC durability. Therefore, both structural design and maintenance should be adapted to these new environmental conditions.

This work focuses on the assessment of the costs and benefits of two climate adaptation strategies for existing RC structures subjected to chloride ingress and climate change. R C structures built in France at different periods under different construction codes (CCBA, BAEL, EUROCODE) will be studied in this work. Concerning environmental actions, historic weather records are used to estimate the current deterioration state and several climate change scenarios will be considered for the assessment of climate change effects. The adaptation strategies aim to reduce the impact of chloride-induced corrosion damage increasing the corrosion initiation time. It is supposed herein that adaptation strategies will take place after a repair action in which the chloride-polluted concrete cover is rebuilt. These adaptation strategies are: (i) increase in concrete cover, and (ii) increase in strength grade of concrete. Their cost-effectiveness will be measured in terms of Benefit to Cost Ratio (BCR) and the probability that BCR exceeds unity –i.e., Pr(BCR>1). BCR is selected because it seems to be a metric that government and policy makers are familiar with. The results of the paper will provide practical advice to policy makers to improve the management of RC structures under a changing climate.

Keywords: chloride ingress, climate change, climate adaptation, reinforced concrete, corrosion, cost-benefit ratio, reliability, existing structures.

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