An Experimental Study on the Concrete Durability

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Summary

The paper provides a tentative for a practical model of assessing the corrosion of reinforcing steel in concrete structures. A theoretical model as well as a formula for both the carbonation depth and chloride ion penetration is presented. Experimental programme presents the influence of carbon dioxide on depth of carbonation.

Keywords: Concrete, Durability, Reinforcement corrosion, Concrete carbonation, Chloride ion penetration, Experimental determination of carbonation, Phenolphthalein test.

1. Introduction

Reinforced concrete structures that are subjected to environmental conditions are likely, after a certain period of exposure, to exhibit signs of distress – initial period of reinforcement corrosion process – due to the concrete carbonation and/or the ingress of chlorides. Theoretical calculations and modelling of the depth of penetration in certain time demonstrate the difficulties of involving, with real influence, of the important parameters. But for engineers, who have to study the durability of the concrete structures, a quantitative model of reinforcement corrosion is necessary. Such useful model, which does not need experimental determinations, is offered in this paper.

The paper deals with a large experimental programme concerning the carbonation of the concrete. The experimental determinations are used for assessing the stage of reinforcement corrosion in existing structures.

The tests reported in the paper refer to 5 types of the concretes and 6 different concentrations of CO_2 . The duration of the experimental programme was of 930 days (2,5 years) when the samples were kept in the special installation with different concentration of CO_2 .

Some interesting experimental results are reported in the paper. The correlation depth of carbonation vs. concrete strength and the correlation depth of carbonation vs. CO_2 concentration are presented.

2. A theoretical model of carbonations and chloride penetration [3]

The initial period occurs chiefly in two different ways: carbonation of the concrete surrounding the reinforcement and presence of chloride. The mechanism of concrete carbonations is similar with chloride ingress because some factors of influence are the same; chloride ingress depends on the many other factors than concrete carbonation.

https://doi.org/10.2749/222137807796119942