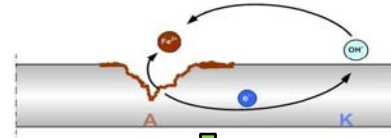


Rapid Chloride Migration test Study on the method

RESEARCH SCHOOL
INTEGRAL DESIGN OF STRUCTURES

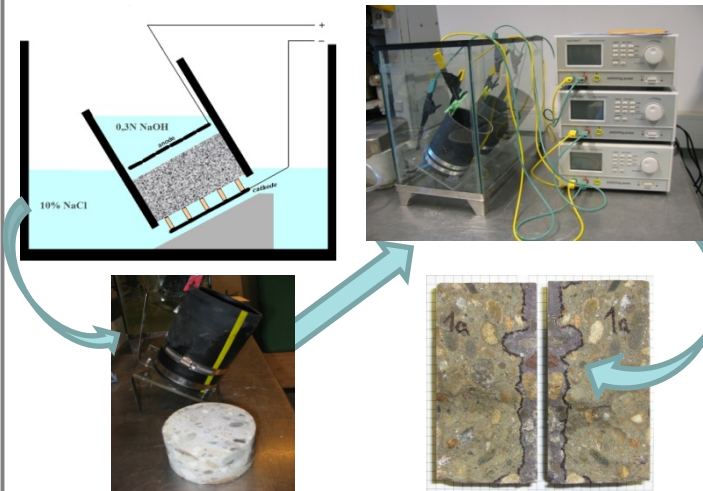
Subject: Durability of concrete in marine environment

When concrete is exposed to a chloride-bearing solution, there is a risk for its deterioration due to the corrosion of steel reinforcement. Thus, the speed of chloride-ions ingress in concrete is determining its durability.



Goal: A reliable and practical test method for quantification of the chloride-ion diffusivity in concrete

The Rapid Chloride Migration (test) is considered to be the most promising accelerated test method for quantification of the chloride-ion penetration speed in concrete.



Results:

A theoretical and practical evaluation of the RCM test was performed. The chloride transport model adopted in the method is found to be incorrect at some points.

The effect of polarization of the electrodes used in the test set-up was measured.

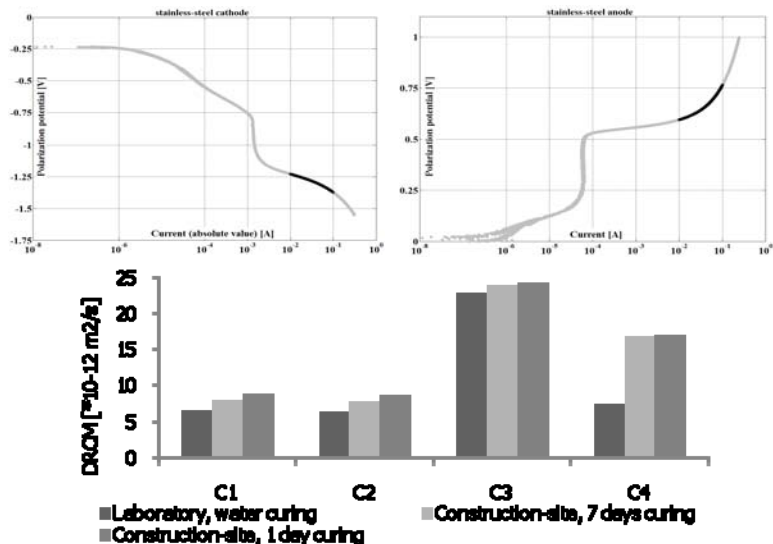
The difference in quality between inner and outer layers of concrete was investigated as the test procedure prescribe to test only the inner layers.

Further expectations:

Development of an improved chloride transport model for the RCM test method.

Modification of the test procedure in accordance to the new transport model.

Application of the modified test method for chloride diffusivity measurements in concrete.



Durability of concrete in marine environment

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Subject: Durability of concrete in marine environment

This research project concerns the durability of concrete exposed to chlorides. When a concrete is in frequent contact with sea water or de-icing salts, corrosion of steel-reinforcement is the dominant deterioration mechanism in the majority of cases. In view of problems with chloride-induced corrosion there is a need for quantified information on transport properties of concrete. When reliable information on chloride ingress-in-time is obtained, concrete in existing structures can be better assessed or new concrete with improved durability can be designed.

Goals:

- ❖ Evaluation of the Rapid Chloride Migration (RCM) test and introduction of improvements
- ❖ Experimental and theoretical studies on the critical chloride content
- ❖ Study of destructive and non-destructive tests to monitor permeability and chloride profiles in real structures
- ❖ Study of the chloride profiles and their relations with exposition conditions
- ❖ Improvements and application of a new concrete Mix-Design Tool, based on the optimized particles packing density, in order to design concretes with improved durability

Research Question:

A reliable and practical laboratory test method to quantify chlorides transport properties in concrete is required. The RCM test fulfils the criterion of practicality, but is it reliable?

According to the reviewed literature, the critical chloride content at the steel-reinforcement level in concrete, varies within the range of 0.2 - 2% of cement mass. Which value is correct and from what is it dependent?

Strategy:

In the first step, this research will focus on the evaluation and development of the Rapid Chloride Migration (RCM) test, to obtain reliable information on ingress of chlorides. A thorough theoretical analysis of the RCM test method will be performed and this analysis will be validated by a modified and adjustable RCM set-up.

In the next step, the set-up will be used to collect the information on concrete resistance against ingress of chlorides from specimens drilled from existing structures (bridges, storm surge barriers etc.). This data will be used to assess the current conditions of the concrete constructions and to predict their service-life.

Moreover, a new concrete Mix-Design Tool, based on the optimized particles packing density, will be applied in order to design concretes characterized with an improved durability.

Expected Results:

- ❖ Reliable and practical chloride ingress testing method
- ❖ Assessment of condition of real concrete elements and structures exposed to chlorides
- ❖ Design of concrete characterized with improved durability

Sponsors:

This research project is sponsored by the user-group of the Cement-Immobilisates-Concrete

Prime Publications:

- ❖ P. Spiesz, H.J.H. Brouwers, Evaluation of the Rapid Chloride Migration test, Proceedings of the 17th International Conference on Building Materials (IBAU-SIL), 2-0723 – 2-0728 , 23-26 September 2009, Weimar, Germany
- ❖ P. Spiesz, H.J.H. Brouwers, Analysis of the Rapid Chloride Migration test, Proceedings of the 3^d International PhD-Student Workshop on Modelling the Durability of Reinforced Concrete, 22-24 October 2009, Guimaraes, Portugal

Research Period:

2008 - 2012