Monitoring the Durability of Concrete Structures

Calculation of Chloride Ingress

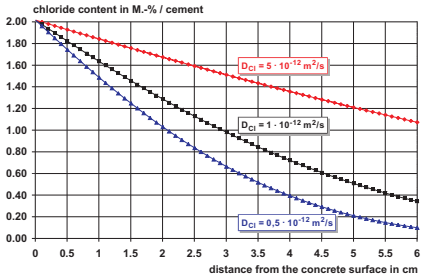
Detoriation Model

$$C_X = C_{SN}\left[1 - \mathrm{erf}\frac{x_c}{2\sqrt{D_o \cdot k_t \cdot (\frac{t_o}{t})^n \cdot t}}\right]$$

C_X : threshold level
C_{SN} : notional surface chloride concentration
x_c : concrete cover
D_o : chloride migration coefficient
k_t : test method factor
t_o : reference period
t : exposure period
n : age factor

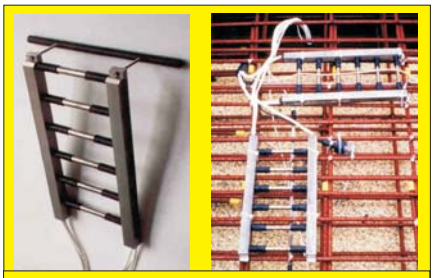
Chloride Profile after 30 a

(surface concentration 2 %)



Corrosion Monitoring System

System for New Structures



Anode Ladder

System for Existing Structures

Expansion Ring System

Requirements

- Robustness and easy handling (transport, installation, concreting, vibration)
- Durability and long-term stability (alkaline environment, chlorides)
- No negative effects on structural behaviour ! (e.g. changes of exposed surface, deformations due to temperature
- Possibilities to check the system (redundancy)

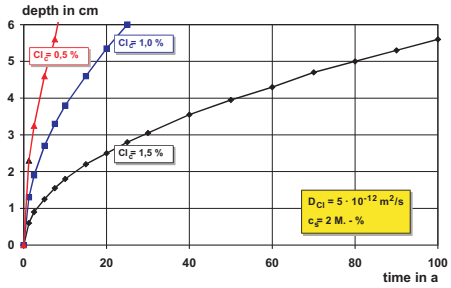
Measurements

- Portable measuring instrument CANIN-LTM for 1000 data-sets

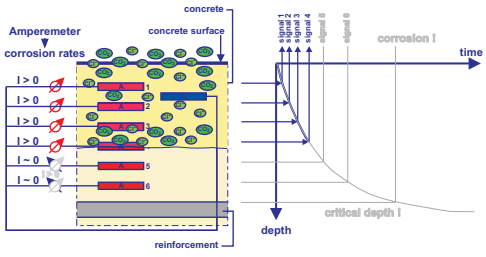
- Automatic datalogger system with data transmission via GPM

Critical Depths over Time

Calculations



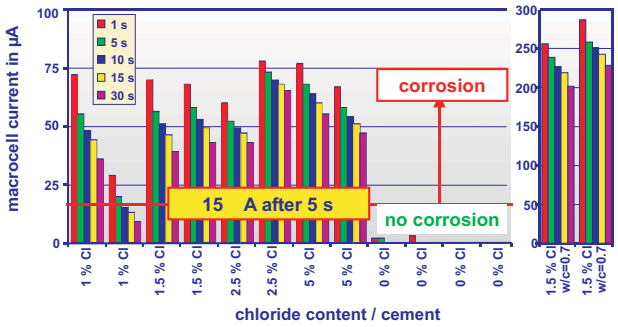
Monitoring



Example of Application: Great Belt Link / Western Bridge

Great Belt Link

Calibration Tests



Construction joints Piers / Caissons in sea-water

Pier-shafts in sea-water

Conclusions and Outlook

Monitoring of New Structures

- Improved sensors available
- Experience from different structures

Monitoring of Existing Structures

- Brite-Euram: "Smart Structure"
- Several other projects running

Outlook

- Increasing Data-base
- Implementation of results from monitring into probabilistic durability calculations