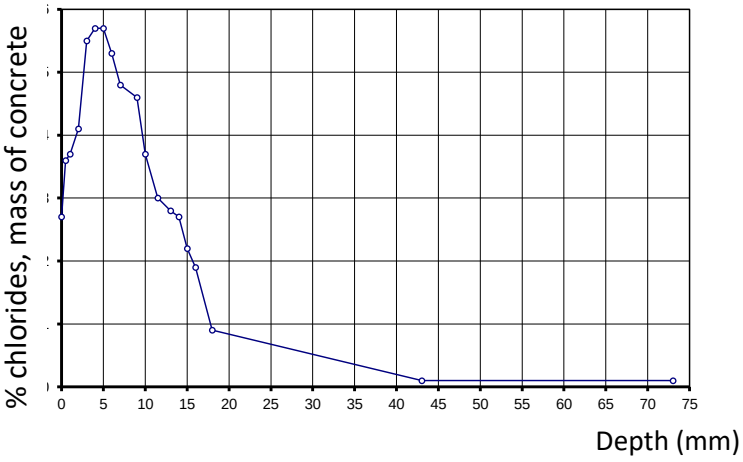
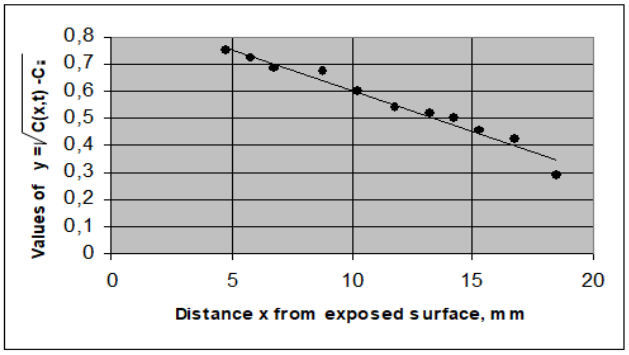
NDTitans in action

Case 1.3 Remaining Service Life of a one year old sea wall, in the splash zone, Denmark

Profile grinding in progress





The quality of the one-year old sea-wall´s cover layer was questioned. The owner wanted an estimation of the remaining service life before corrosion would take place of the reinforcement based on the first years ingress by diffusion of chlorides.

The cover was 50 mm.

Profile grinding for every 0.5 mm depth was performed with the **Profile Grinder** on the wall close in the splash zone. In parallel the **RCT** was used to measure the (light) acid soluble chlorides in percentage of concrete mass.To get the initial chloride content a masonry drill bit 18 mm in diameter was used to get a powder sample at 43 mm depth, respectably at 72 mm depth, behind the reinforcement..

The profile obtained is illustrated above. As shown the maximum peak is at a depth of ~5 mm, the depth of the carbonation – measured by the **Rainbow Indicator**.

Fick´s Second Law of Diffusion was applied to the data:

$$C(x,t) = C_i + (C_s - C_i) \cdot erfc \frac{x}{2 \cdot \sqrt{t \cdot D_0}}$$

D_O being the apparent diffusion coefficient, C_s the surface concentration of chlorides and C_i the initial chloride content (0.0094 Cl-/mass)

Linear regression analysis of the data was performed

Producing the following relationship y = 0,9060 – 0,0302 x and the chloride concentration at the surface as:

Cs = 0,90602 + 0,0094 = 0,830 % Cl by concrete mass

and the apparent chloride diffusion coefficient of

$$D_0 = \frac{\left(\frac{0,9060}{0,0302}\right)^2}{12 \cdot 1,0} = 75 \ mm^2 / year$$

First year ingress:

$$K_1 = \left(1 - \sqrt{\frac{0,0500 - 0,0094}{0,8300 - 0,0094}}\right) \cdot \sqrt{12 \cdot 75} = 23,3 \ mm \ per \ \sqrt{year}$$

And the remaining service life for a critical concentration of 0.050% Cl /mass for corrosion to start out, and a cover layer of 50 mm:

$$t = \left(\frac{50}{23,3}\right)^2 = 5 \ years$$

Case prepared by **NDTitan Claus Germann Petersen**