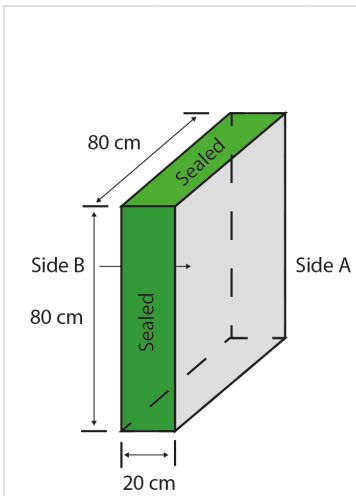
Exercise 8: Determination of cover concrete properties

Background

A series of laboratory tests were carried out on two 80/80/20 cm reinforced concrete walls, cast in a vertical position (Figure 1). The cement used for the walls was CEM I 42.5, with a dosage of 300 kg/m^3. The concretes for the two walls differ in their water/cement ratio, i.e. W/C = 0.43 for low wall 1 (with a superplasticizer admixture) and W/C = 0.52 for wall 2. One vertical side of the formwork per wall (side B) was fitted with a CPF (Controlled Permeability Formliner) membrane between the formwork panel and the concrete surface until the formwork was stripped, in order to obtain a less permeable, more compact concrete skin. The principle of draining formwork by using a CPF membrane is based on the evacuation of excess water and air from freshly poured concrete in areas close to the formwork.

The measurements of air permeability $\mathbf{kT_{i,mes}}$ at three different points, carried out at 28 days on the vertical faces A and B of the two walls are given below, with the average value of electrical resistivity ρ at xx days for each face and type of formwork.



Wall 1 - W/C=0.43 - Side A - wood formwork						
$kT_{i,mes}$	[10^{-16}m^2]	0.020	0.027	0.011	ρ [kΩ.cm]	8.2
$Ln(kT_{i,mes})$		-3.91	-3.61	-4.51		8.2

Wall 1 - W/C=0.43 - Side B - wood formwork + CPF membrane						
$kT_{i,mes}$	[10^{-16}m^2]	0.004	0.022	0.003	ρ [kΩ.cm]	8.2
$Ln(kT_{i,mes})$		-5.52	-3.82	-5.81		

Wall 2 - W/C=0.52 - Side A - wood formwork						
$kT_{i,mes}$	[10^{-16}m^2]	0.095	0.056	0.507	ρ [kΩ.cm]	5.5
$Ln(kT_{i,mes})$		-2.35	-2.88	-0.68		

Wall 2 - W/C=0.52 - Side B - wood formwork + CPF membrane						
$kT_{i,mes}$	[10^{-16}m^2]	0.005	0.004	0.002	ρ [kΩ.cm]	5.5
$Ln(kT_{i,mes})$		-5.30	-5.52	-6.21		

Figure 1 Diagram of walls tested in the laboratory and test results.

Work to be carried out:

1. Using equation (1) given in appendix A1, calculate the geometric mean kT_{geom} of the air permeability values measured for the 4 faces of the 2 walls (for the 2 concretes and the 2 formwork conditions).

2. Classify the average kT_{geom} measurement values and ρ for the 4 faces tested on the 2 walls in the chart provided in appendix A2.

3. Discuss the method and results obtained.

Appendix: Characterization of cover concrete

A1. Geometric mean

According to Torrent (2000), there is a strong correlation between the logarithm of air permeability *kT* and compressive strength. As compressive strength is statistically normally distributed, so is the logarithm of permeability. This indicates that air permeability kT is log-normally distributed, Torrent (2000). The geometric mean of kT is defined by the following formula, where n is the number of measurements Denarié (200x):

$$kT_{geom} = e^{\frac{\sum_{i=1}^{n} Ln(kT_i,mes)}{n}} = \sqrt[n]{\prod_{i=1}^{n} kT_{i,mes}} \quad (1)$$

This value corresponds to the median, which is the value for the 50% fractile. In the case of a symmetrical distribution such as the normal distribution, the median is equal to the arithmetic mean (also known as the mathematical expectation).

A2. Classification into permeability classes (PC)