



Influence of curing temperature on development of compressive strength and resistance to chloride ingress of concrete with different binder systems

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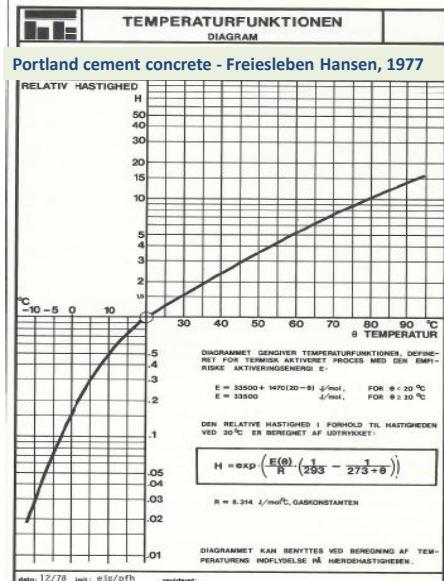
Background

Scope 1

- In Denmark, the maturity concept is used for estimating the strength development of a concrete as a function of temperature – based on data measured at 20 degrees

Input to:

- Optimization of curing
- Striping of formwork
- Evaporation protection
- Selection of binder combination
- Early age crack control

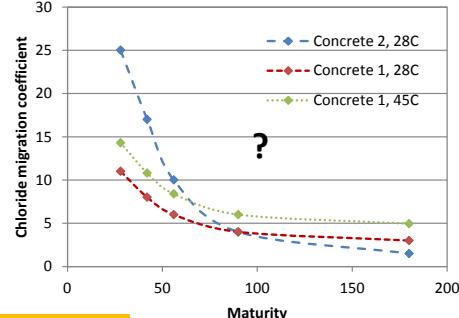




Background

Scope 2

Is it possible to use a similar relation to describe the development of resistance to chloride ingress??



Input to:

- selection of binder combination
- optimization of curing
- choice of maturity at first exposure



Experimental program

RPC

10°C
MPa: 1,2,7,28,
56 days

SRPC

20°C
MPa: 1,2,7,28,
56,180 Days

RPC + 25% fly ash

30°C
MPa: 1,2,7,28,
56 Days

SRPC + 25% fly ash

45°C
MPa: 1,2,7,28,
56 days

CEM III/B

60°C
MPa: 1,2,7,28,
56 Days

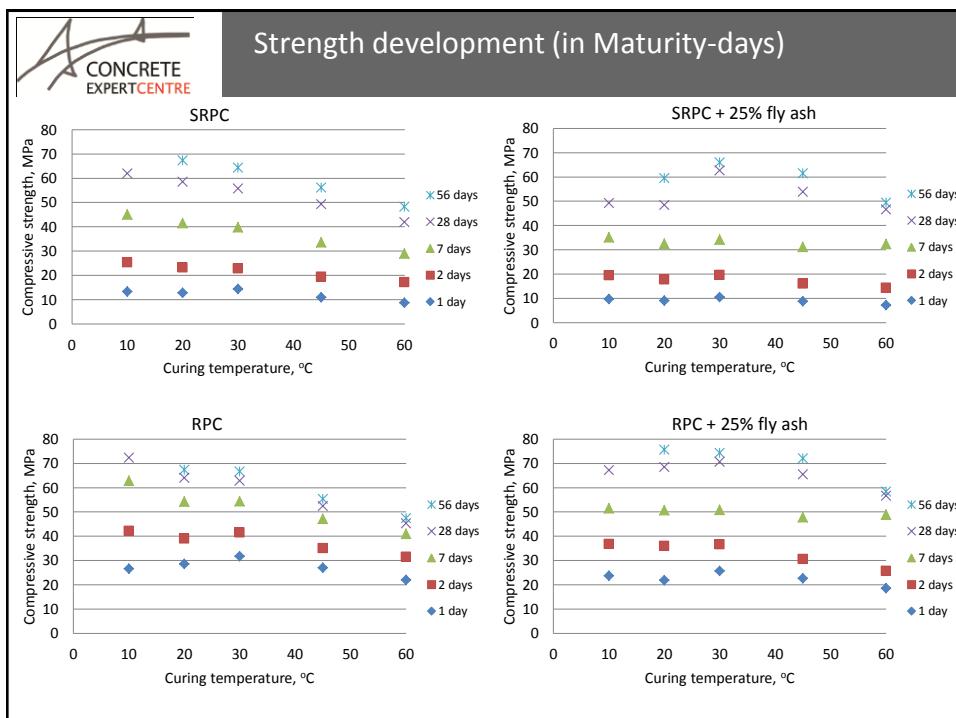
SRPC + 4% SF

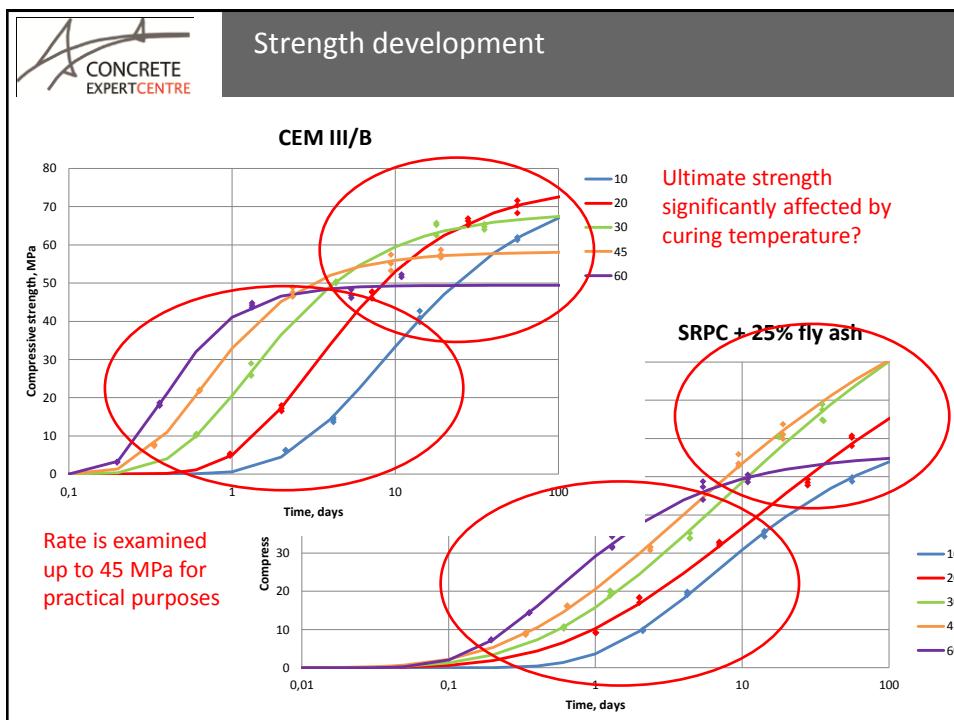
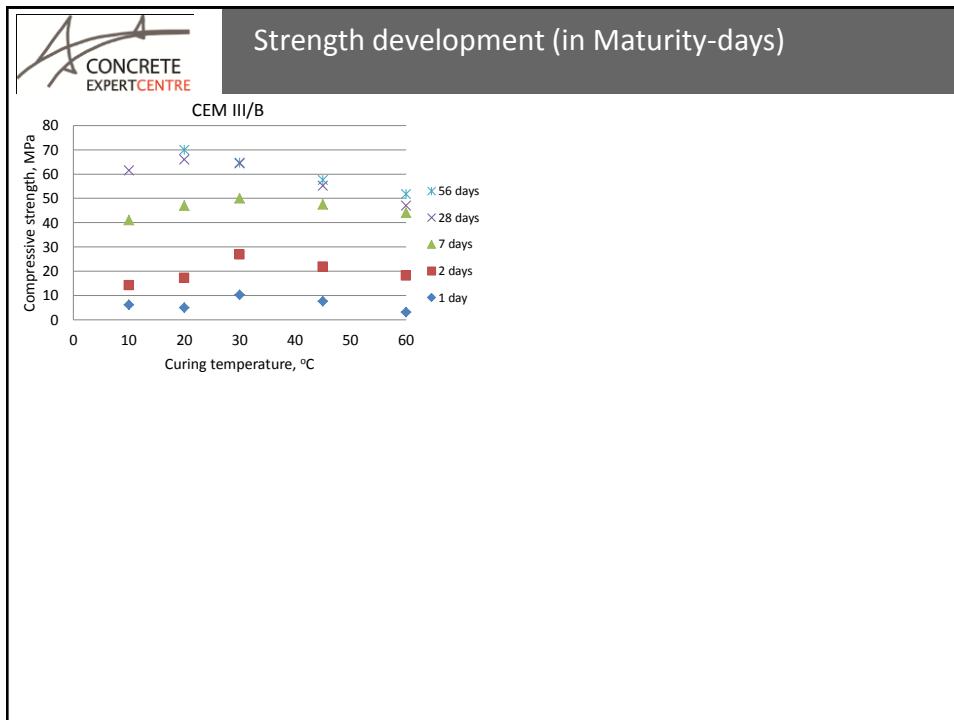
Slump
120-180 mm
ΔAir
content < 0,5%
between
batches
EN 480-
11/batch
NTB388/
batch

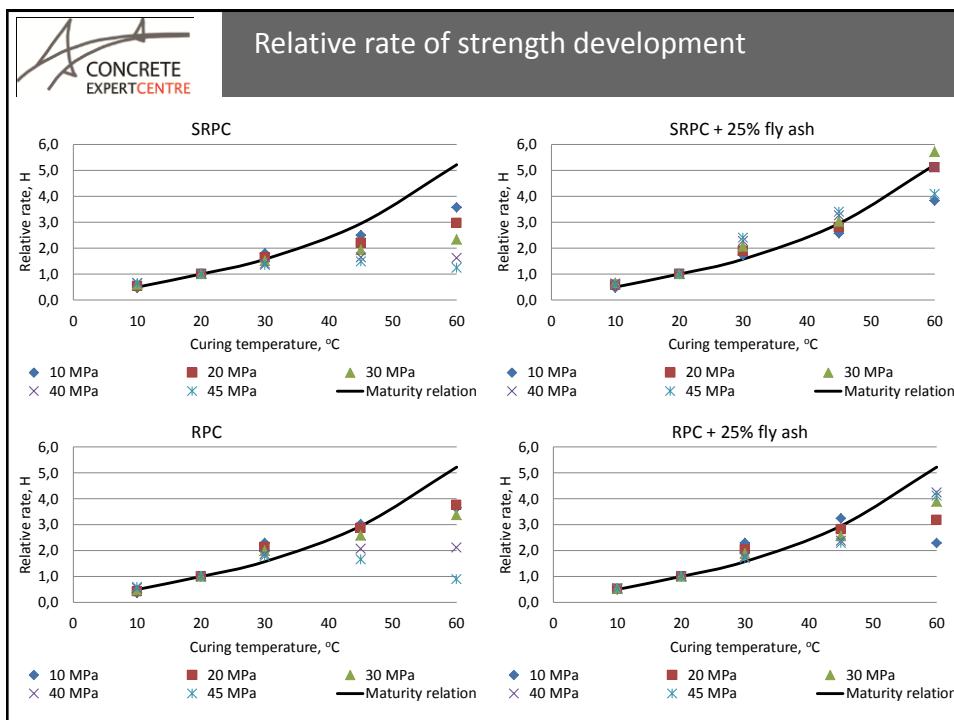
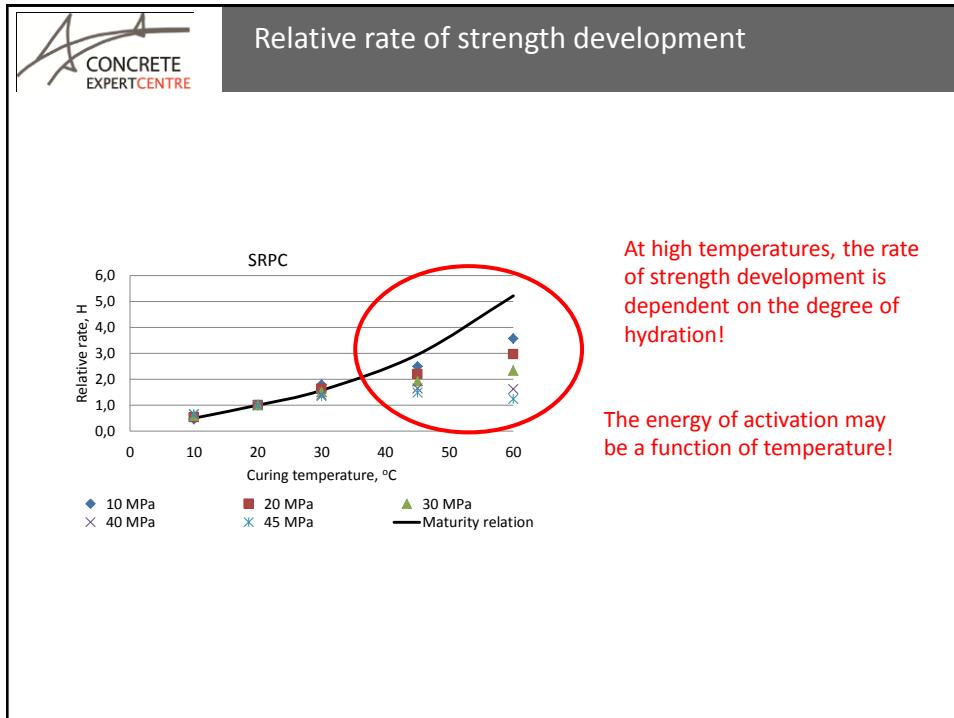
SRPC + 4% SF + 12% FA

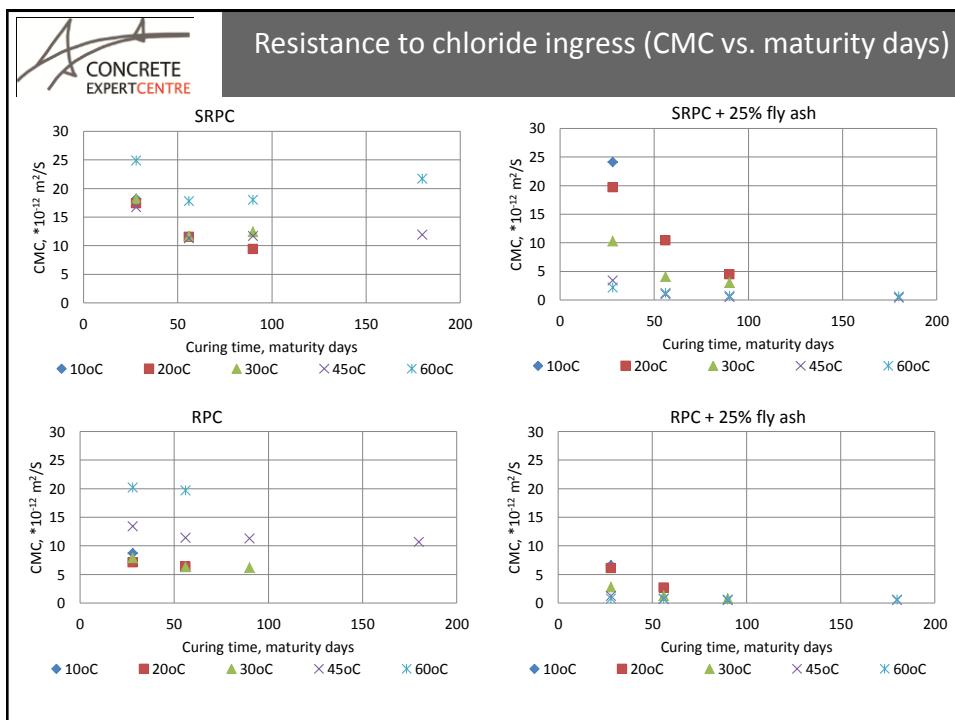
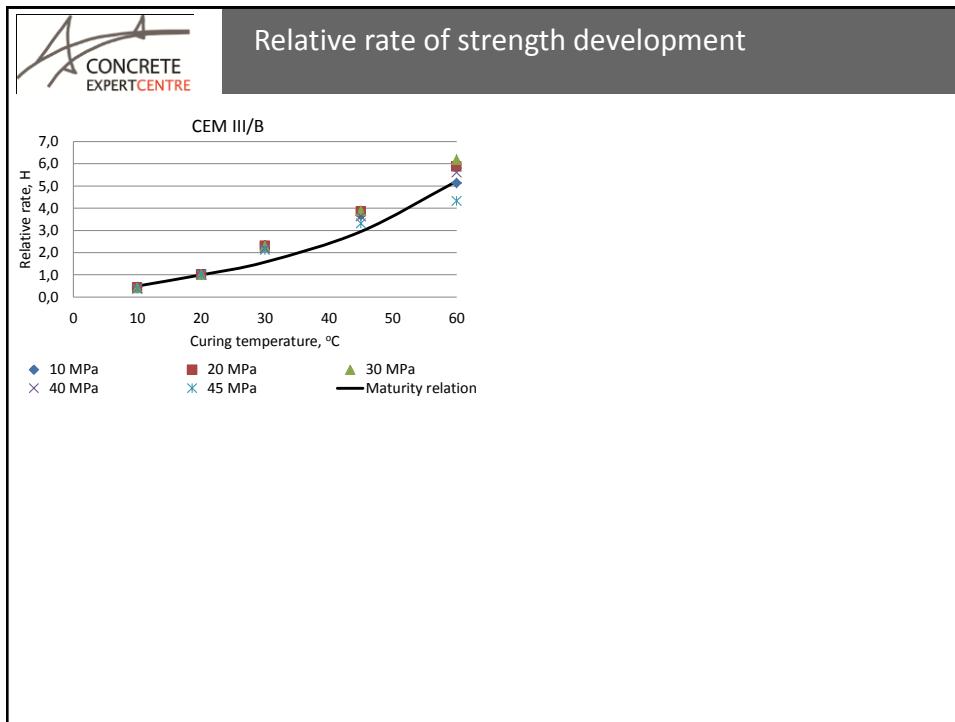
Each concrete type: eq. w/c-ratio at 0.40, dmax = 22 mm

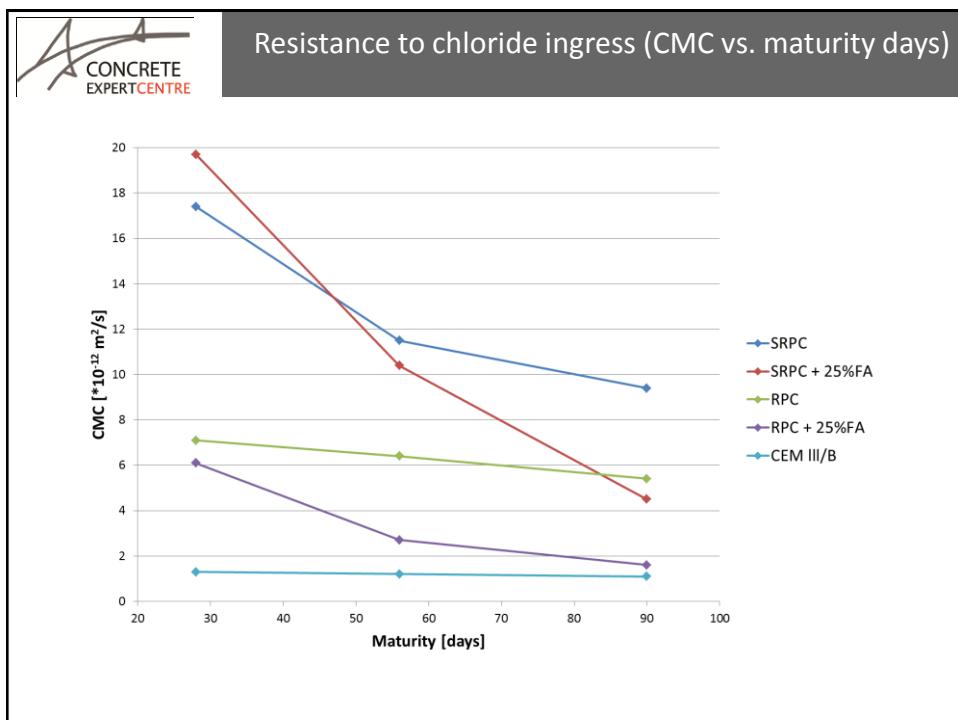
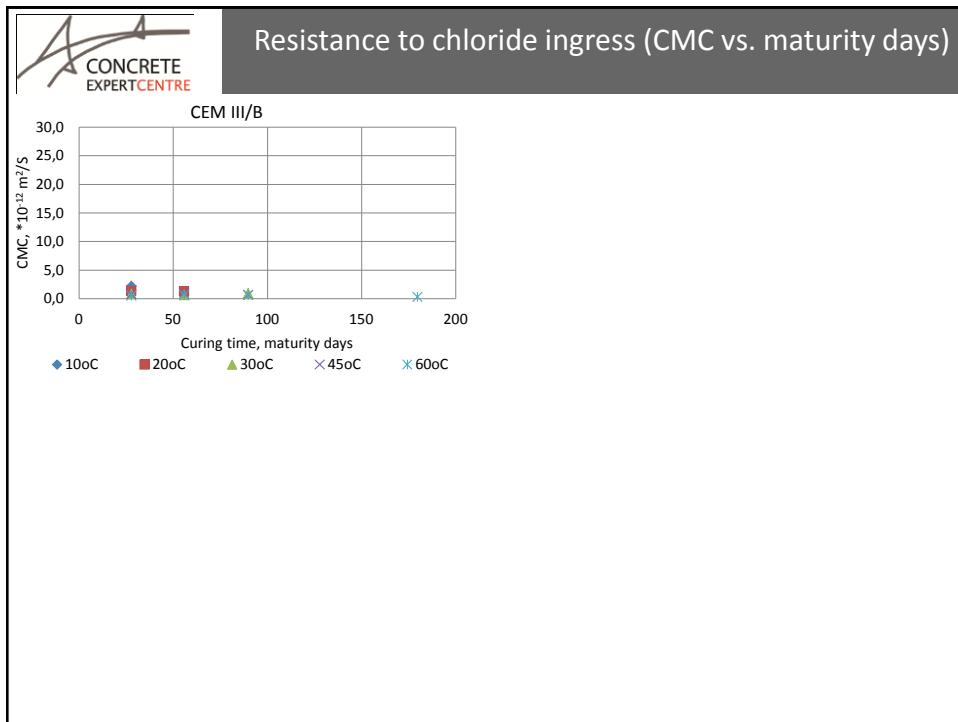
78 Ø150 cylinders
30 Ø100 cylinders } 500 liter

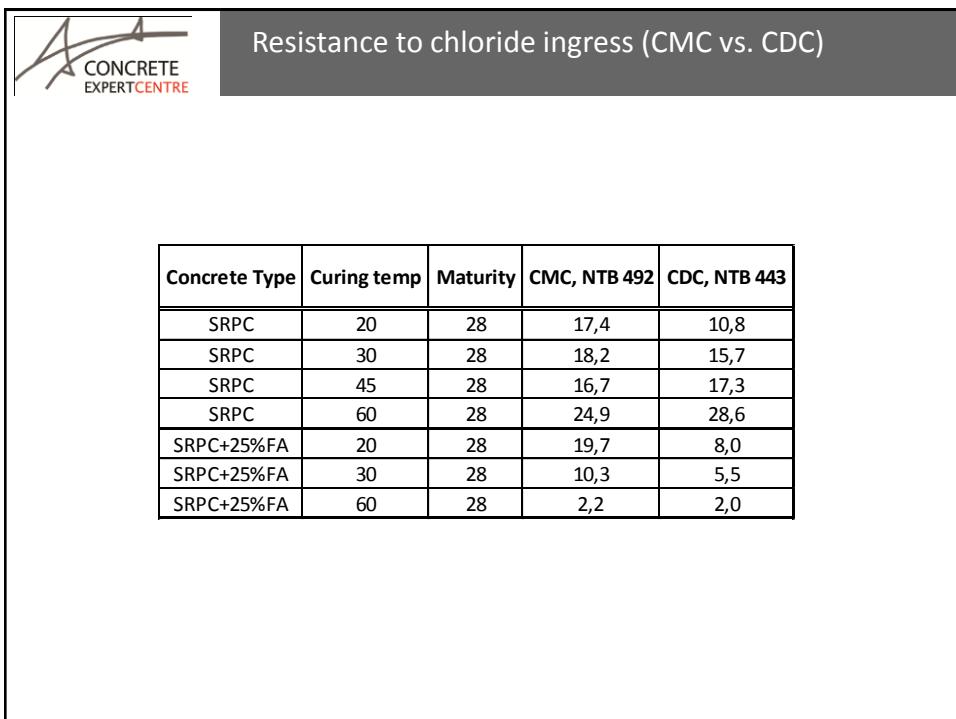
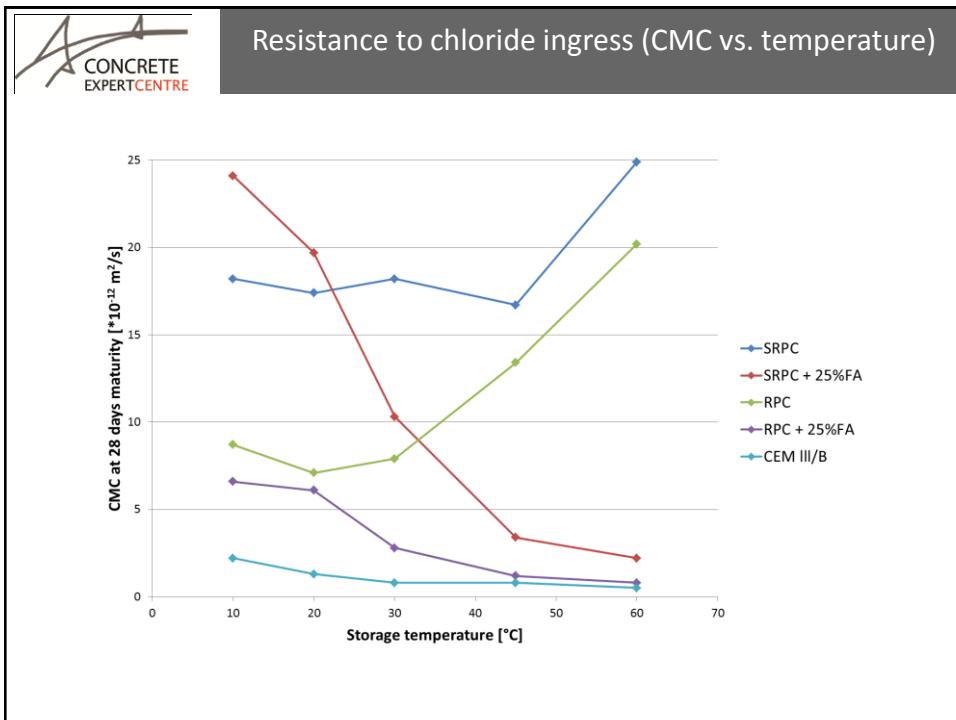


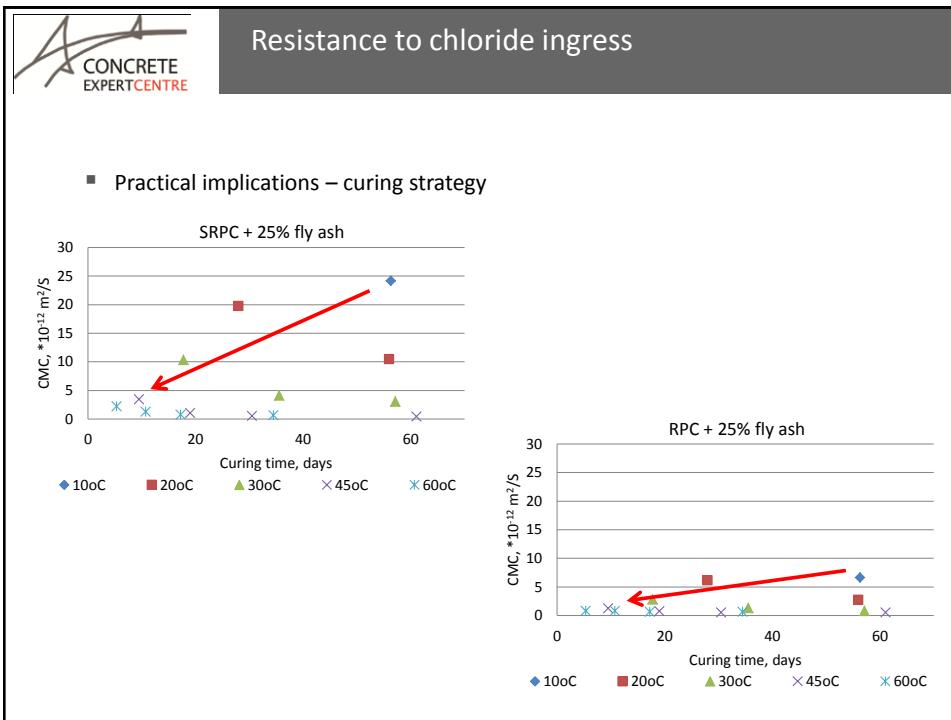












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- ## Concluding remarks
- The maturity relation by Freiesleben provides an accurate description of the rate of strength development for curing temperatures up to $\sim 30^\circ\text{C}$
 - The accuracy of this relation drops significantly for curing temperatures above 30°C , where the rate becomes highly affected by the degree of hydration
 - The ultimate strength of a concrete is remarkably affected at curing temperatures around 60°C
 - Performance of fly ash concretes is greatly improved by high-temperature initial curing
 - Slag cement concretes show very good resistance to chloride ingress at short curing times and at all studied curing temperatures
 - All studied concretes show remarkably different behaviour with respect to both strength development and resistance to chloride ingress, and therefore...
 - it is recommended to carry out performance testing of a concrete at different temperatures prior to execution, in order to plan an optimum curing strategy