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Sub-project 2: Frost Resistance of Low-Carbon Concrete

PUOLIVÄLIWEBINAARI – 14.3.2023

AHSAN IQBAL



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Phase - I

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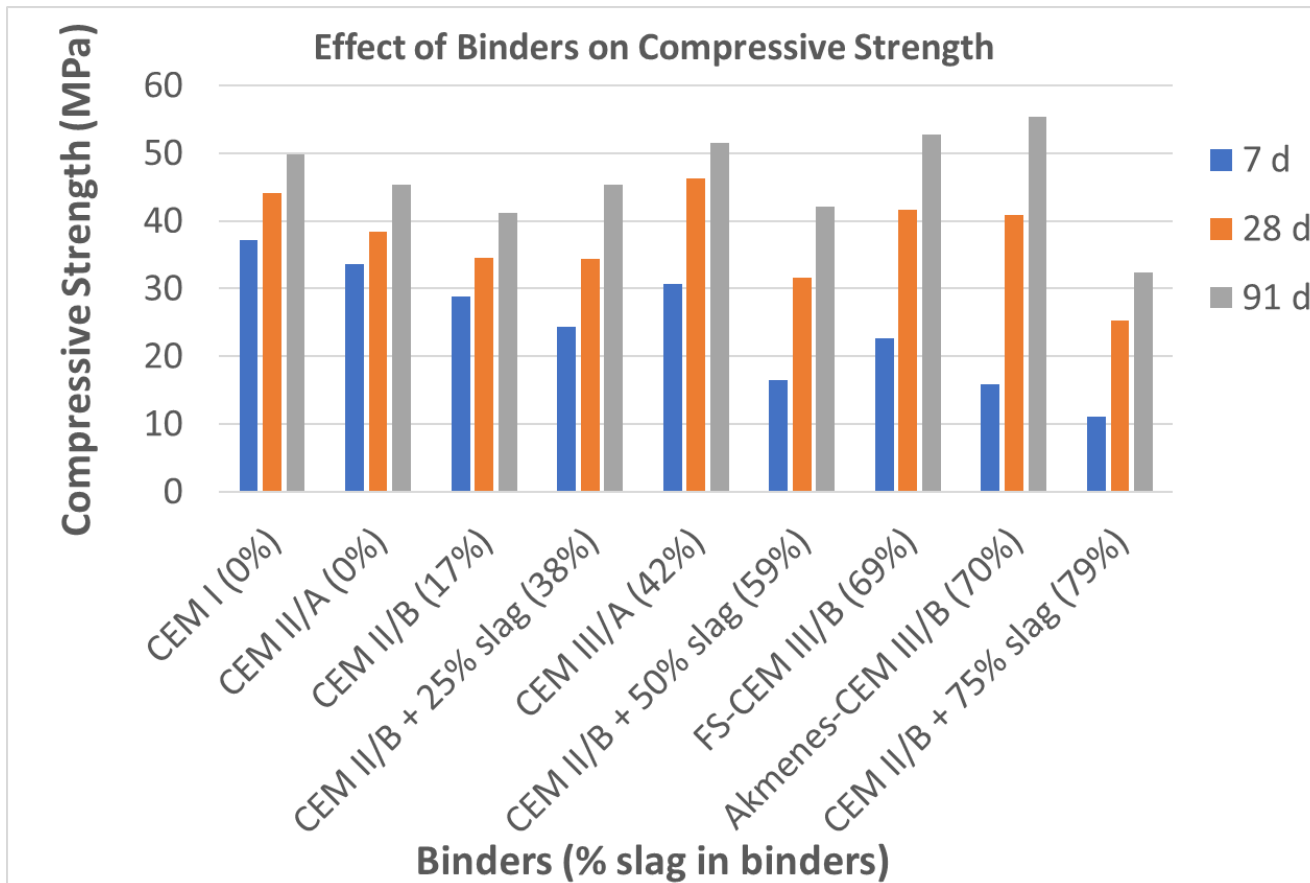
**Effect of slag content
on frost resistance &
compressive strength**

A”

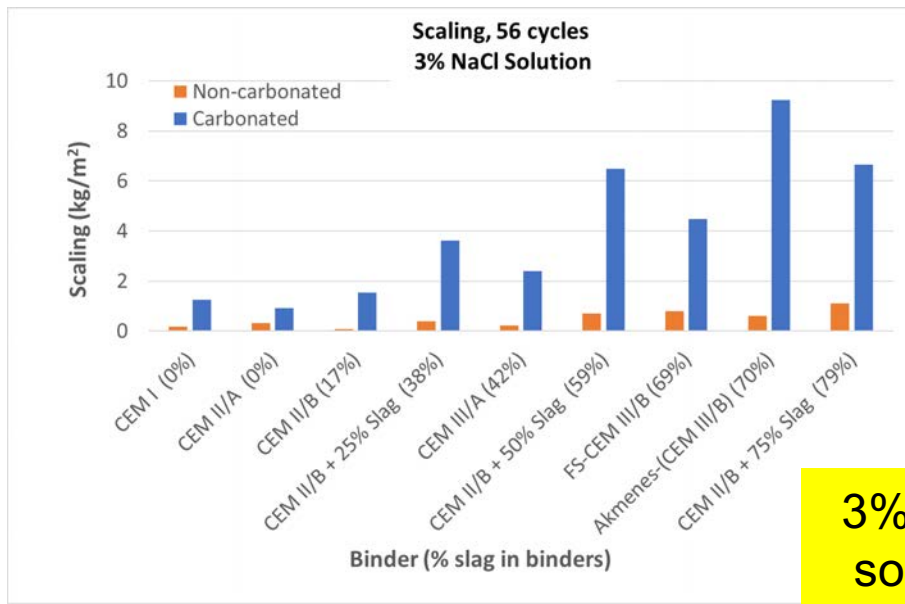
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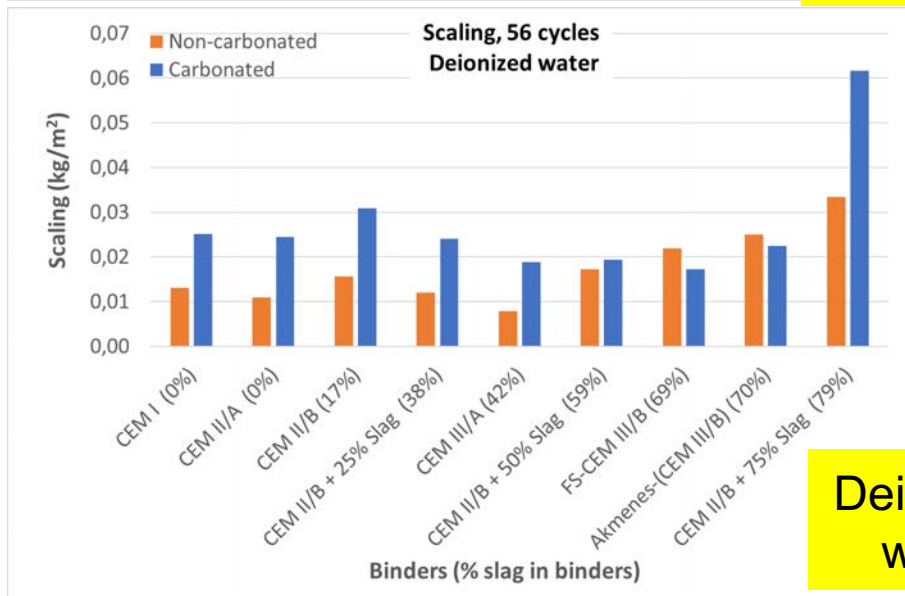
Compressive Strength



Slab test, Scaling

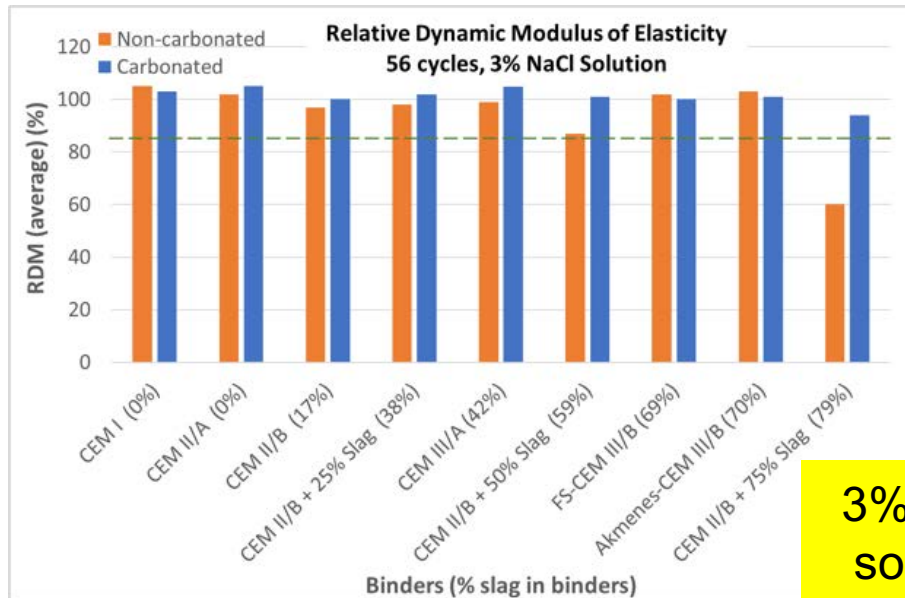


3% NaCl solution

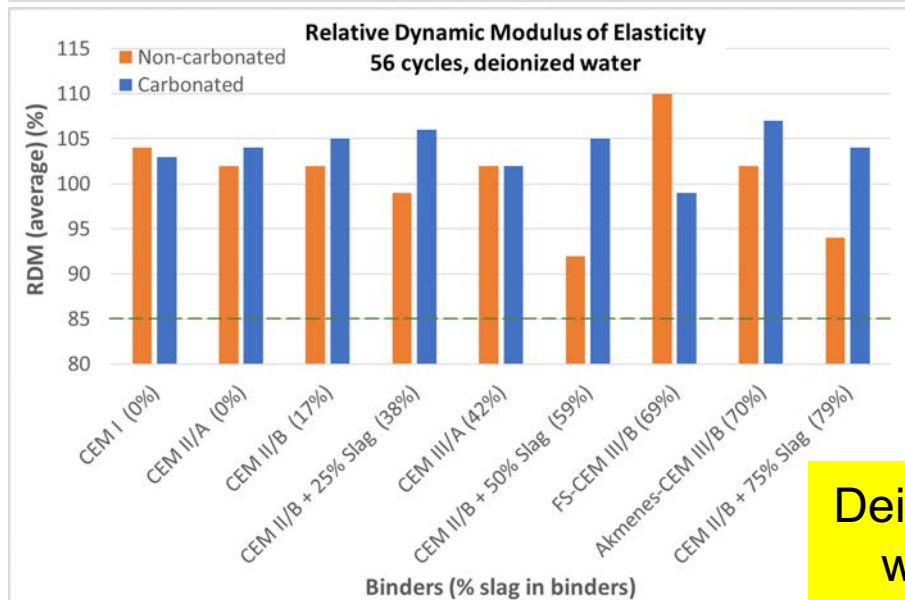


Deionized water

Slab test, Internal Damage (UPV)

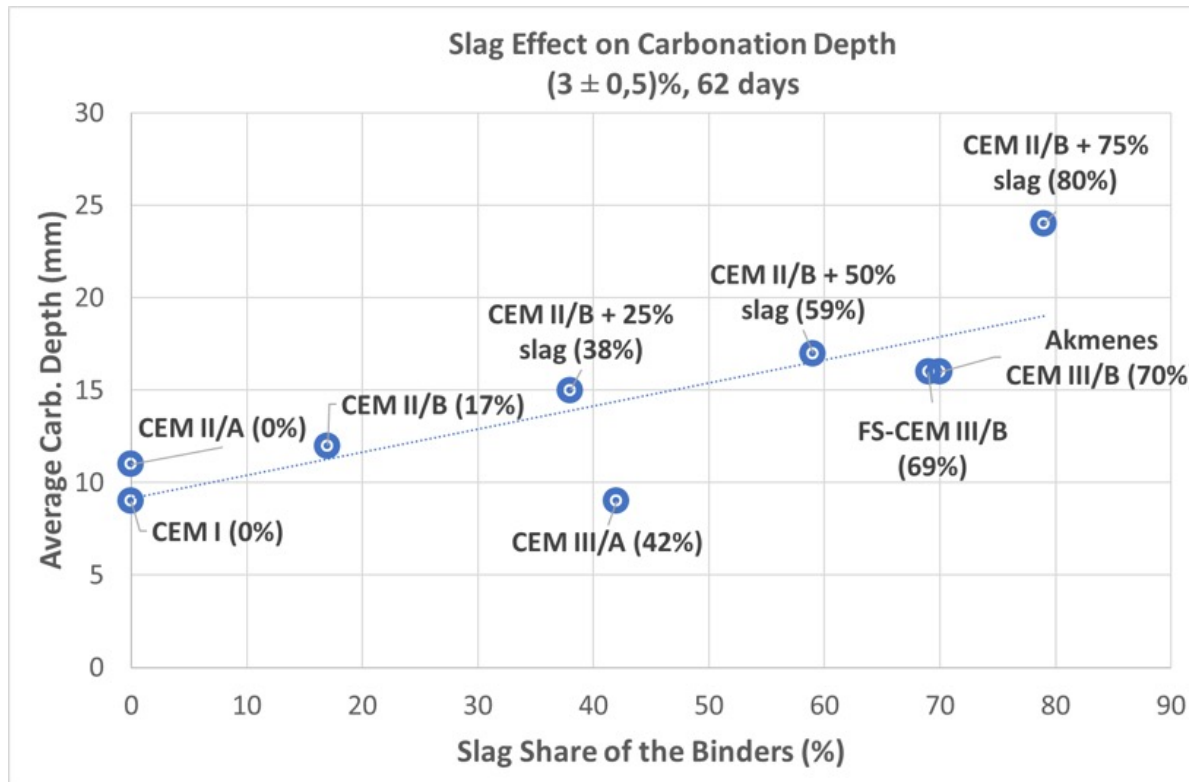


3% NaCl solution



Deionized water

Carbonation Depth vs %Slag

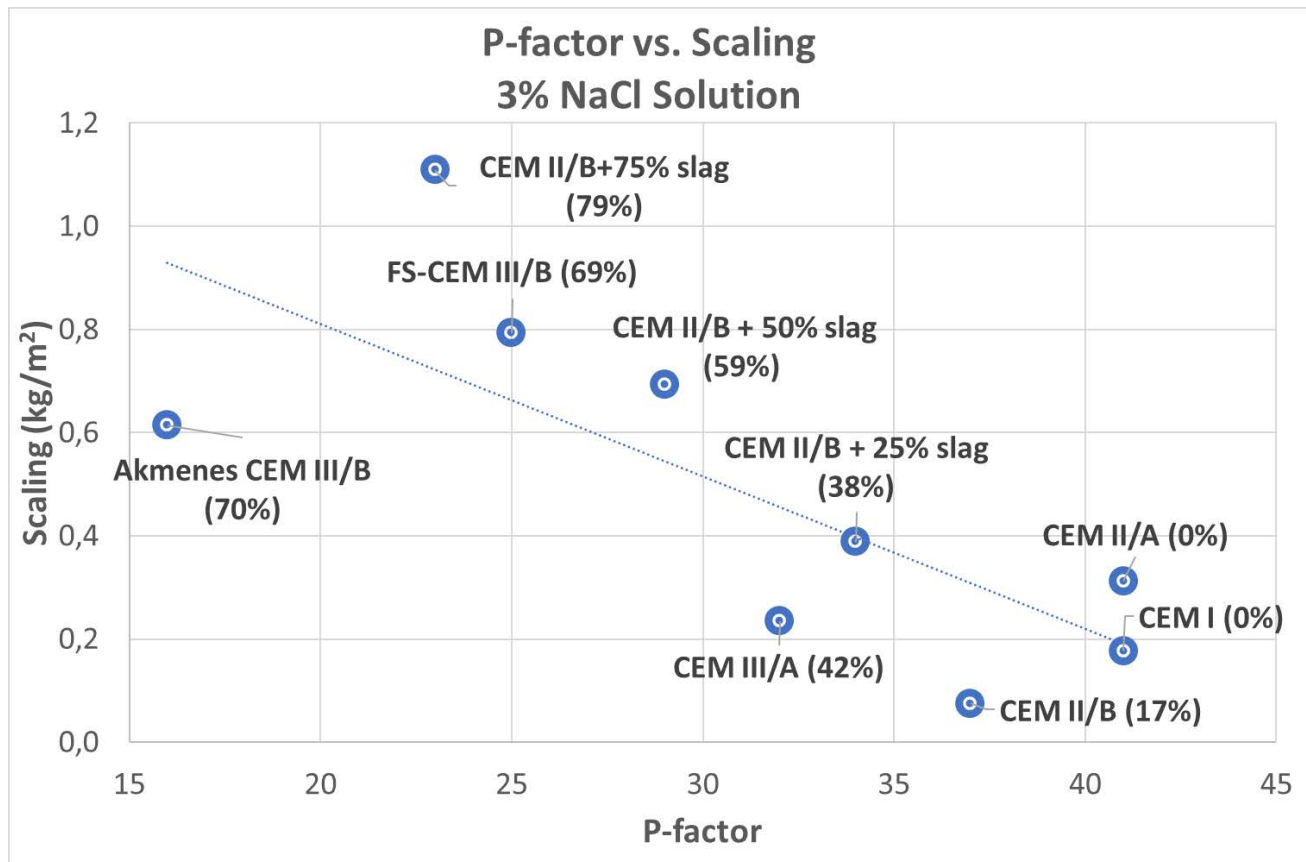


CEM II/A (0%)



CEM II/B (80%)

P-factor vs. Scaling



Phase - II

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Effects of testing age &
carbonation on salt
freeze-thaw resistance

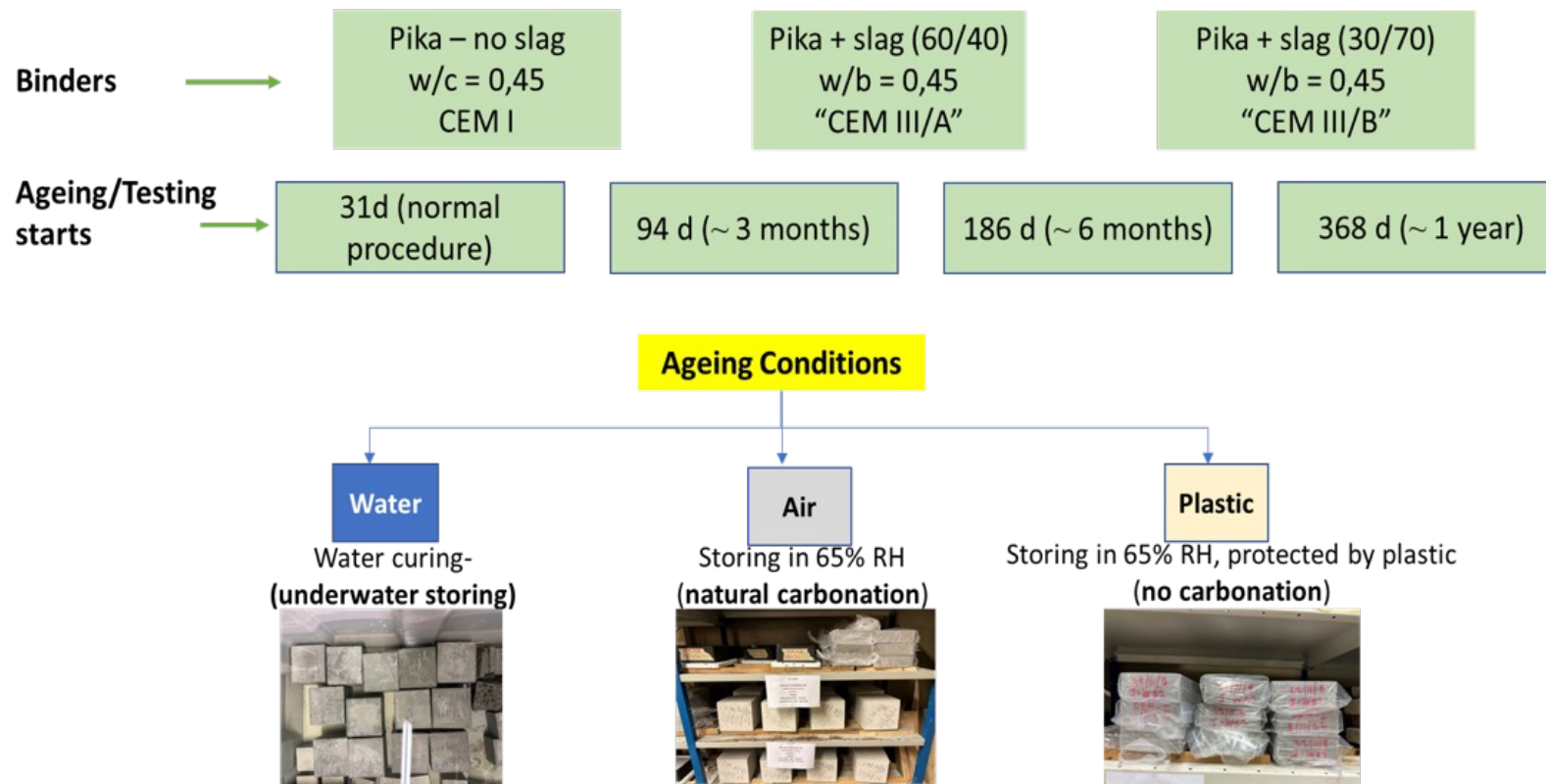


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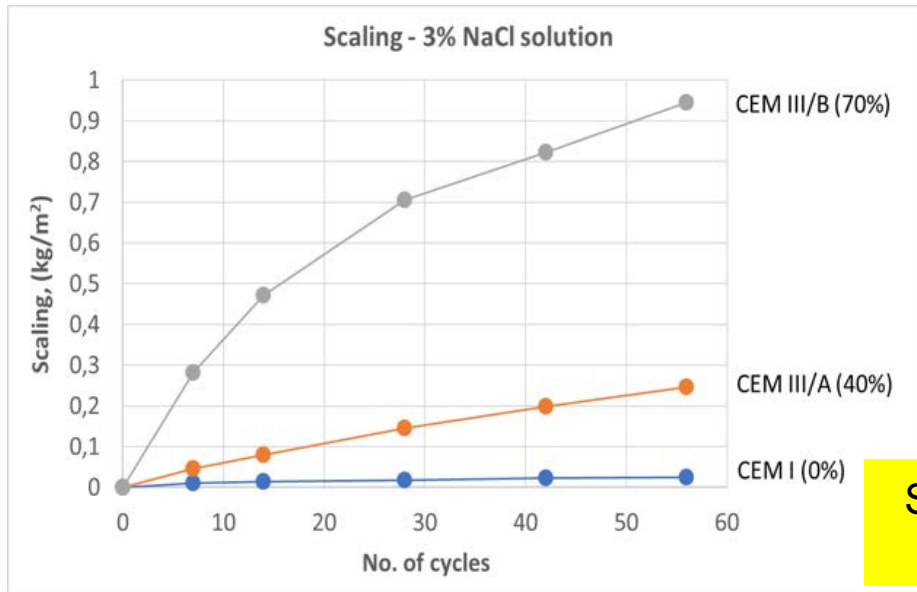
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Salt-frost resistance of low-carbon concrete

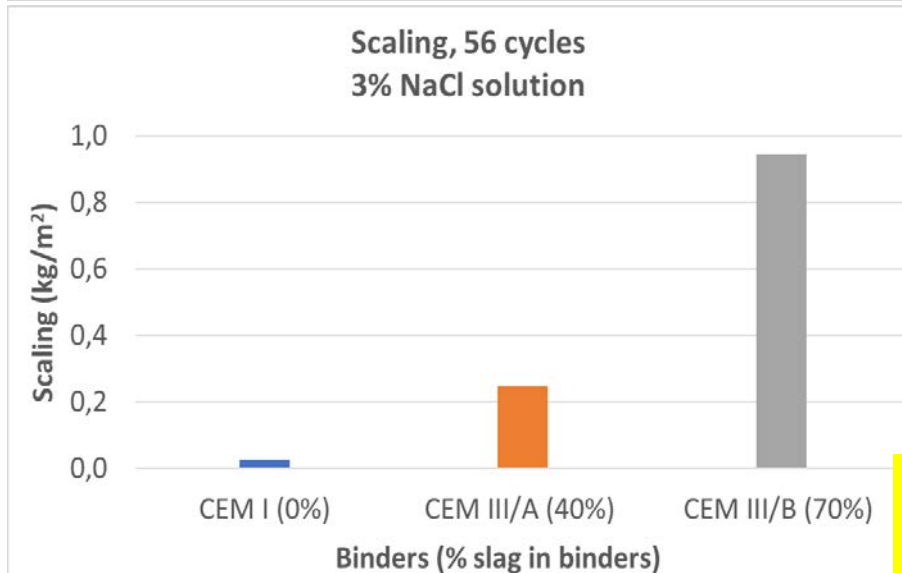
Test program – Effect of curing time and carbonation



Slab test, Scaling (Standard Test Initiation Age 28d)



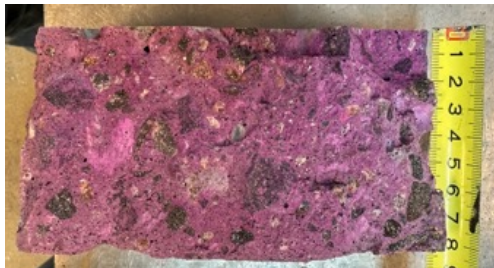
Scaling with Age



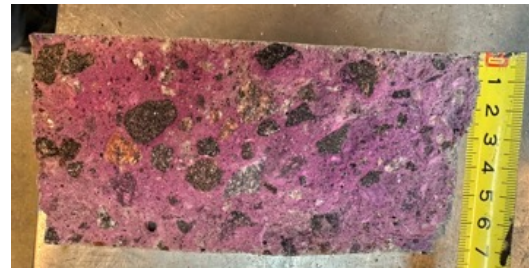
Surface scaling w.r.t % slag

Carbonation Depth (90d)

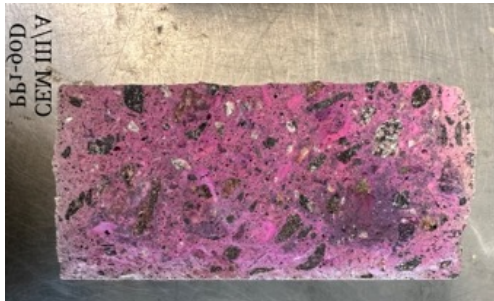
Avg. CO₂ Concentration: (0,04 ± 0,001)%



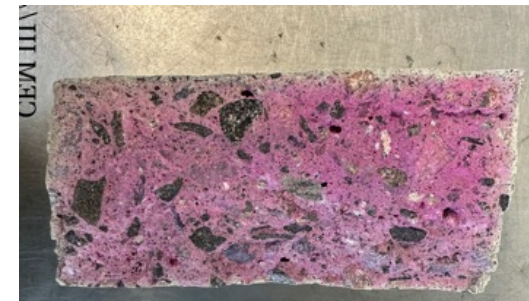
CEM I-Plastic Protected



CEM I-Carbonated



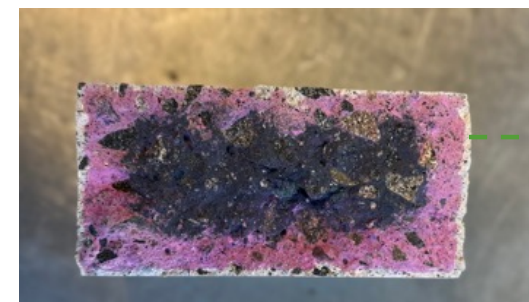
CEM III/A-Plastic Protected



CEM III/A-Carbonated



CEM III/B-Plastic Protected



CEM III/B-Carbonated

Avg. Carbonation depth = 2 mm

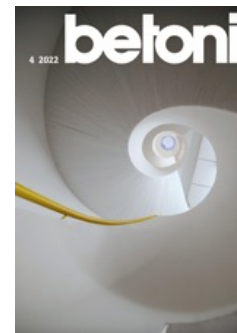
Summary

- Slag initially delays strength development but achieves higher strength than CEM I after 91 days.
- Slag clearly reduces salt F-T resistance, 50% considered to be known critical limit.
- F-T resistance (without salt, exposure classes XF1 & XF3) is less dependent on slag content.
- Internal damage (UPV) appears more important compared to scaling, for F-T resistance without salt.
- Carbonation (ageing) amplifies scaling significantly with high slag content.

More information: <https://betoni.com/lehti/2022/12/08/vahahiilisten-betonien-sailyvyysominaisuudet/>

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Thank you for your attention!

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Any Questions? Comments!

The logo consists of a large, bold, white letter 'A' with a double quote symbol (”) to its upper right.

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The word 'LOIKKA' is written in a bold, white, sans-serif font, slanted upwards from left to right.