Industrial PhD project

Concrete without Portland cement

Marvin Glissner

What is Alkali activated material (AAM)

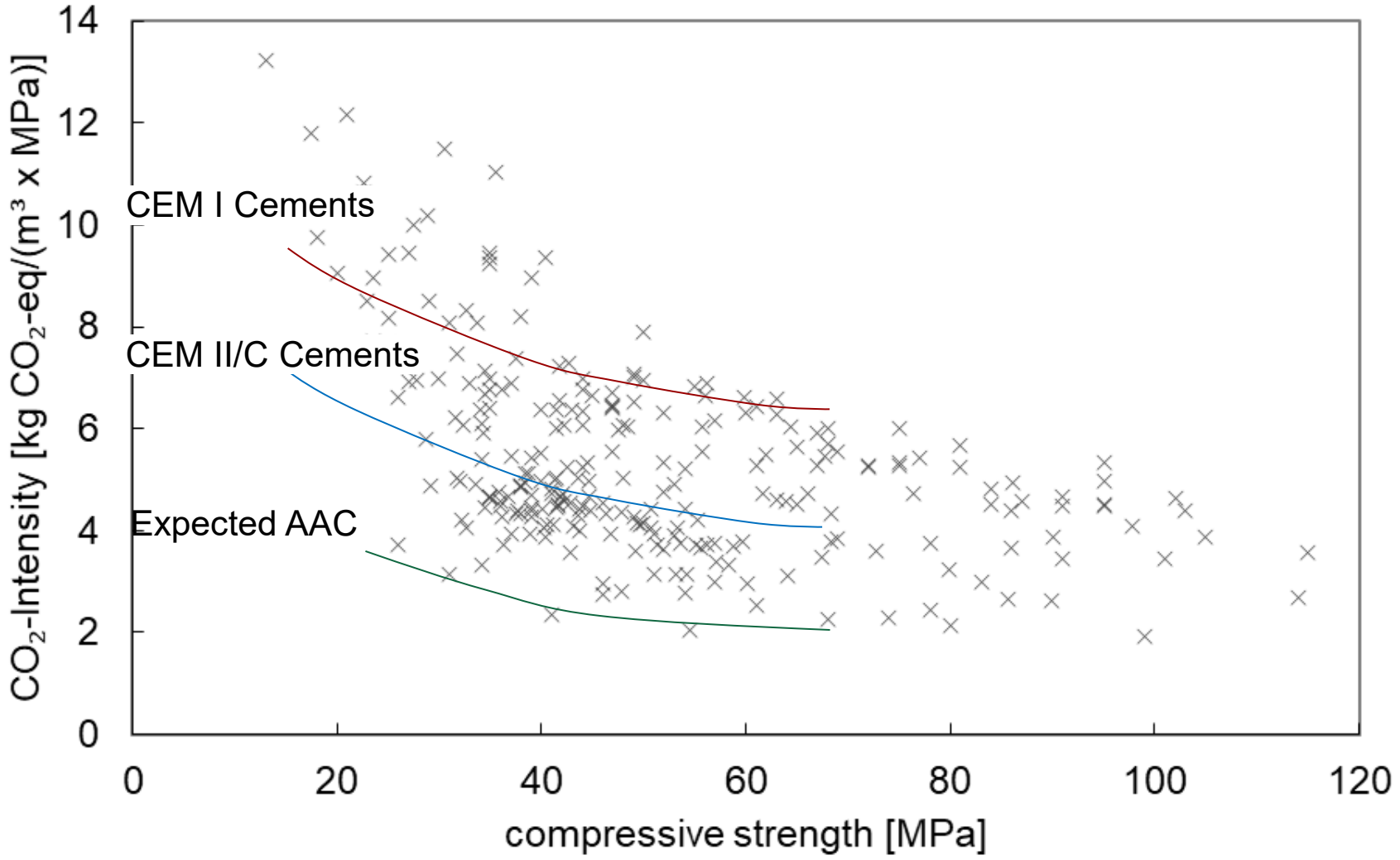
Aluminosilicate Powder

Activator

Water

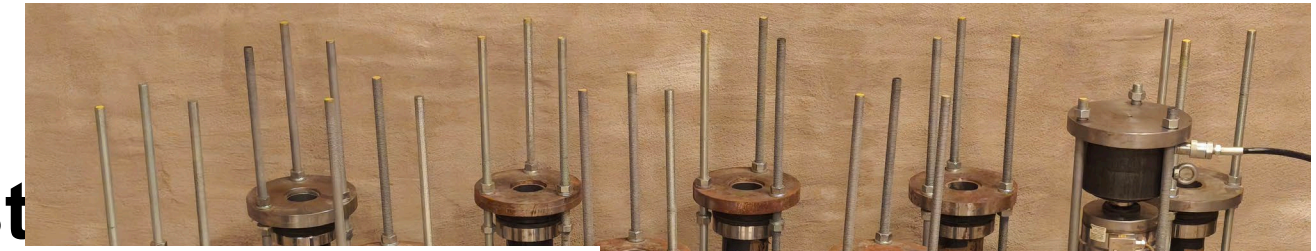
AAM paste

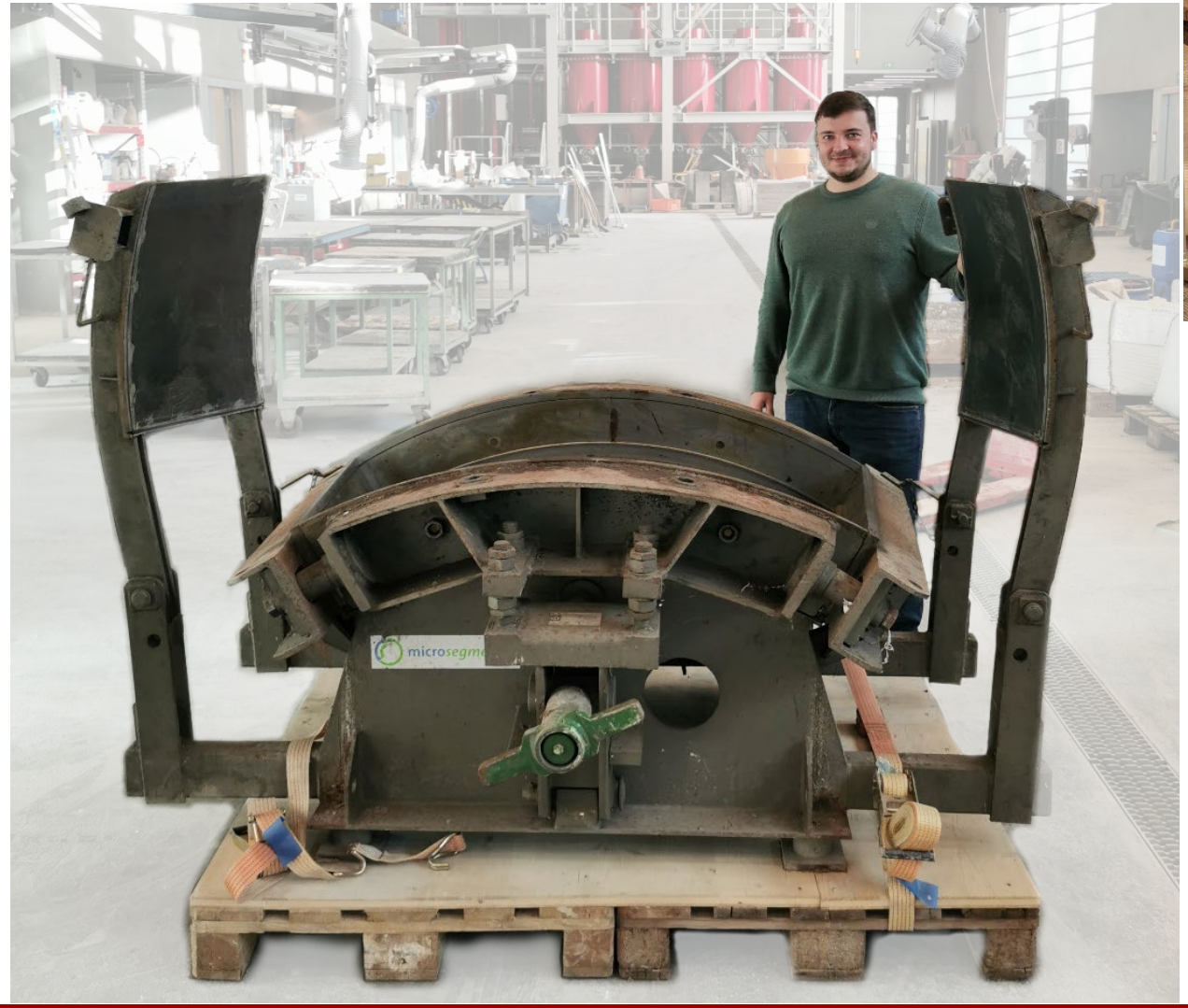
Main interest driver



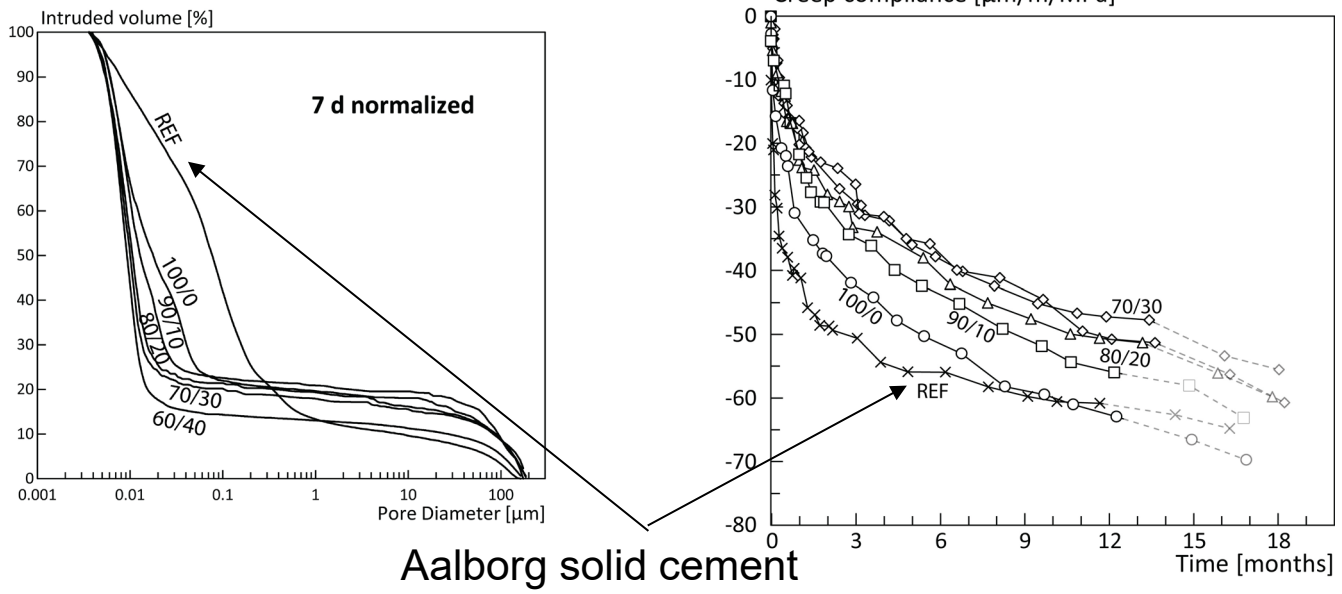
Modified from: M. Schneider, CCR, 124, 2019

A lot of test

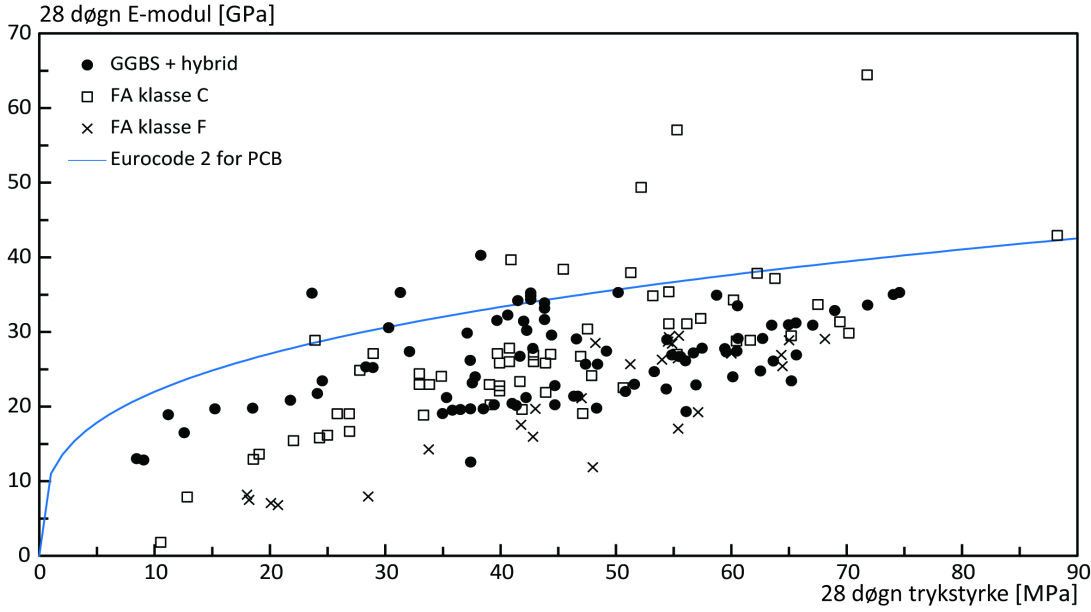




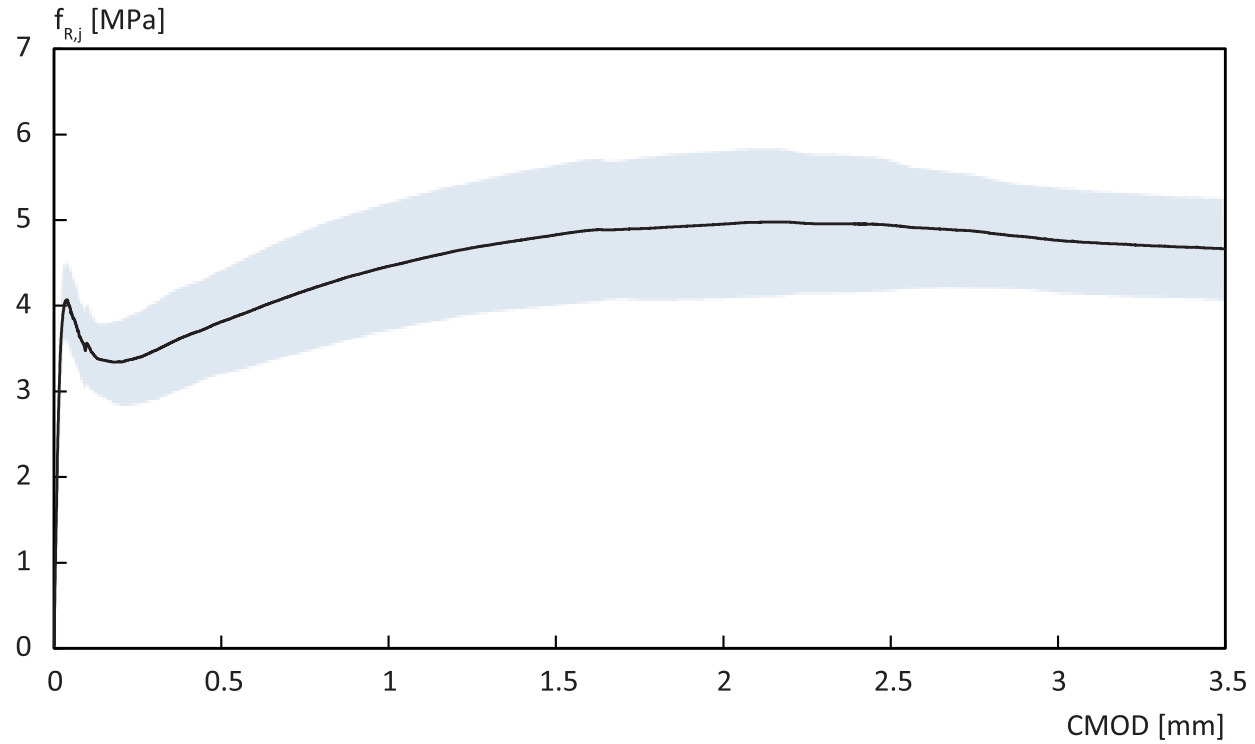
Generate nowledge of material behavior



Aalborg solid cement



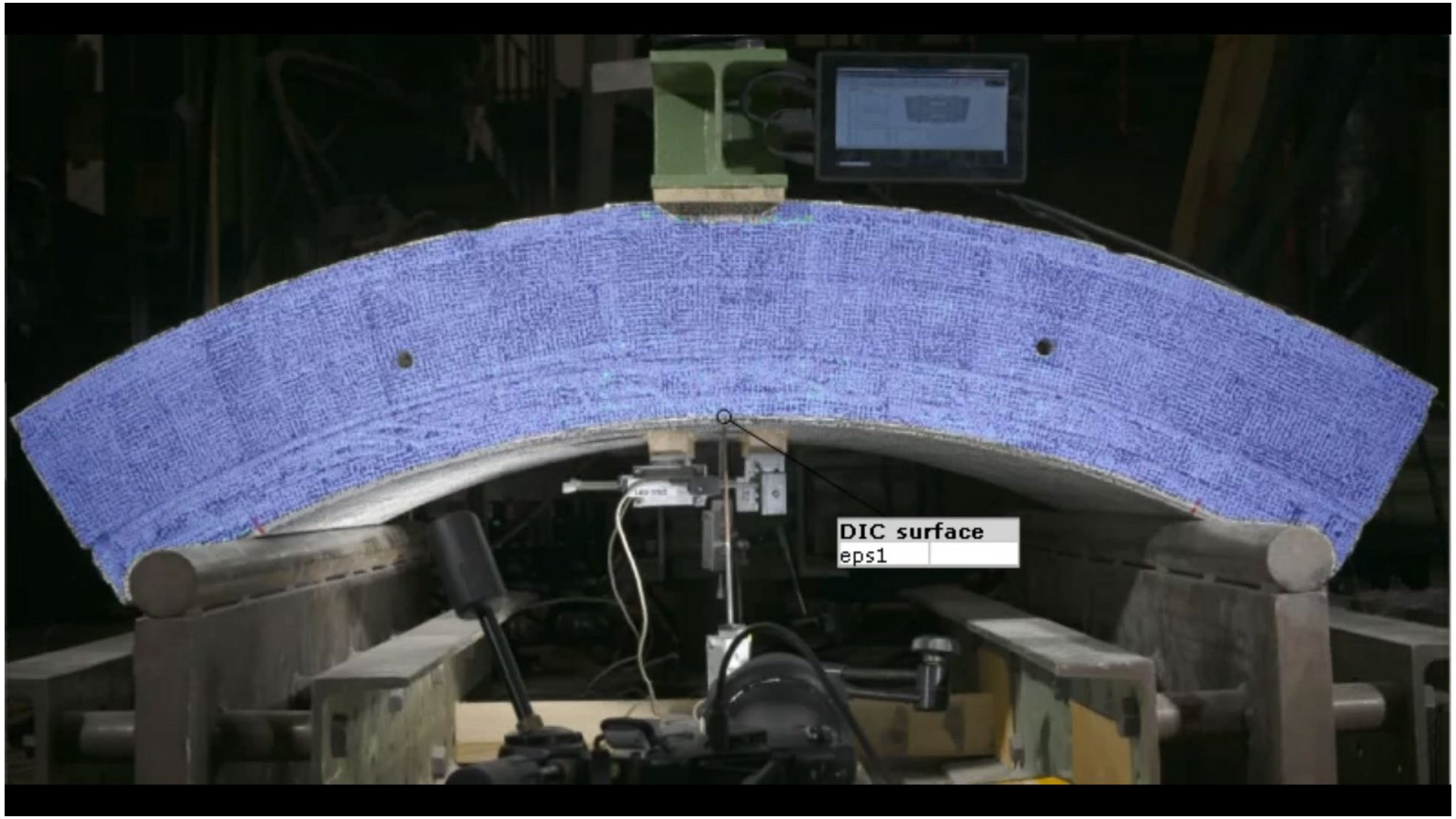
Beams



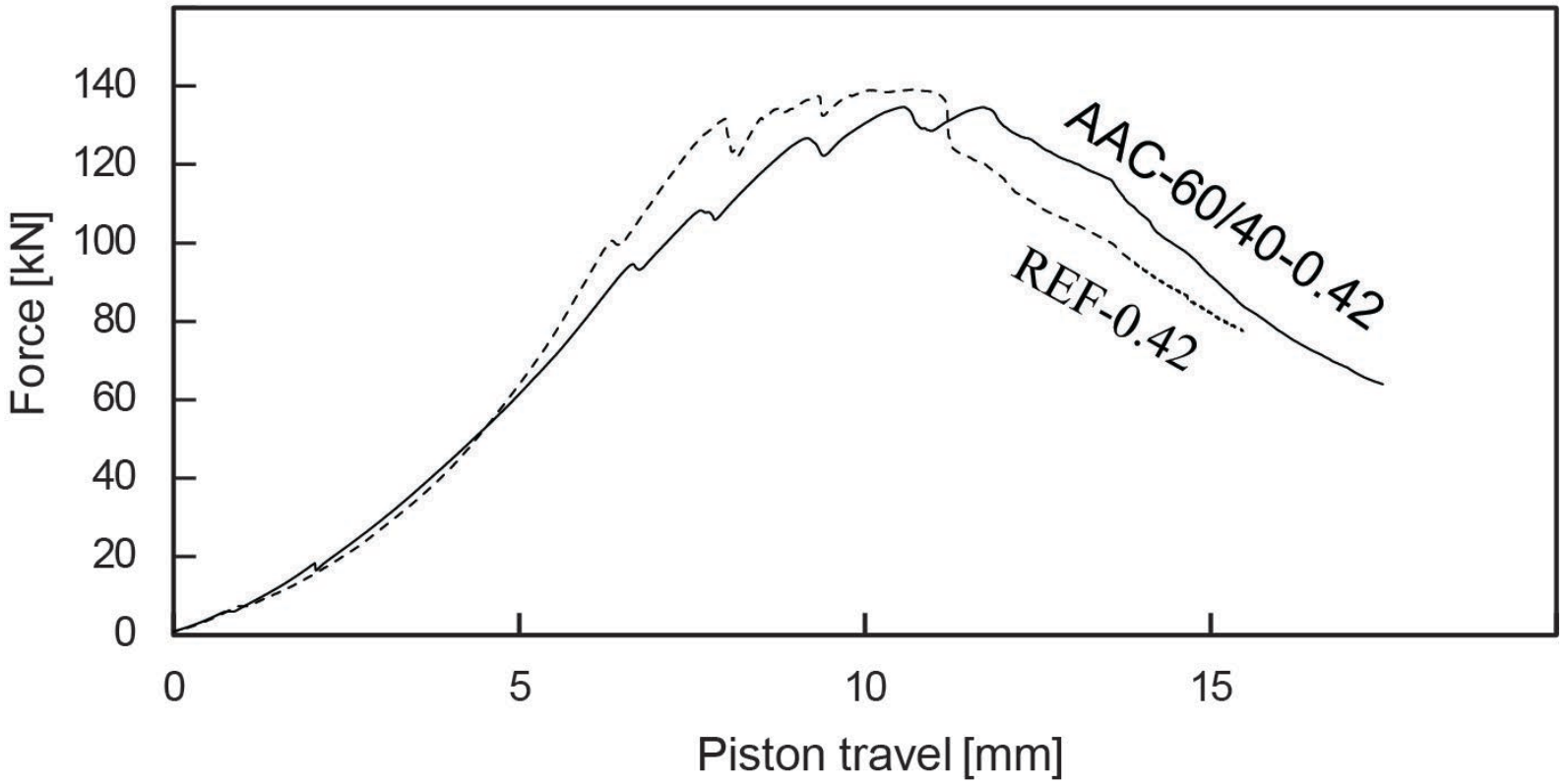
Production AAM

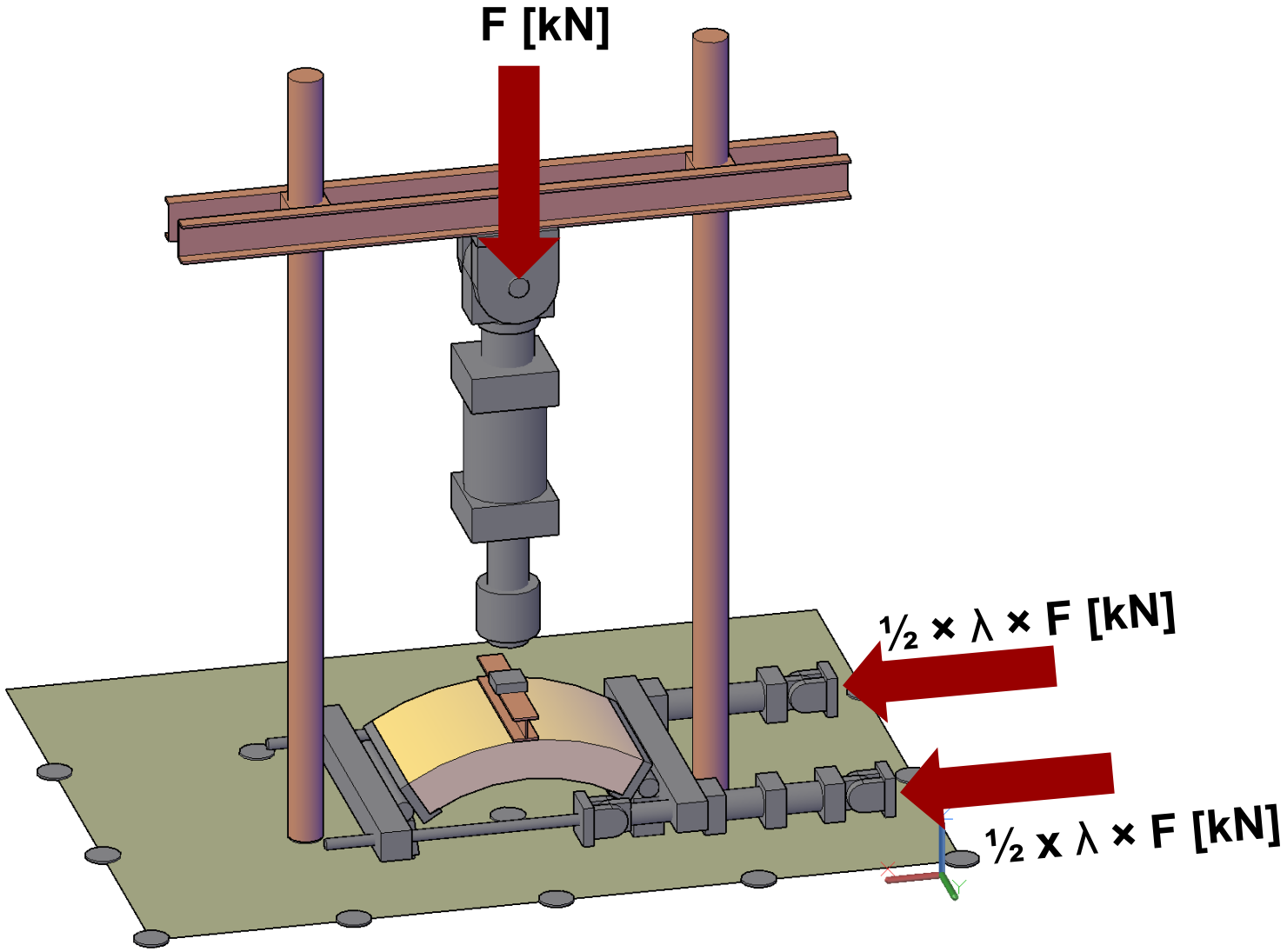
Shortclip production

- 450 kg/m^3 binder
- 40 M.-% calcined clay
- w/b 0.41
- 35 kg/m^3 glued steel fibres


DIC surface
eps1

Tunnel element comparison




F [kN]
½ × λ × F [kN]
½ x λ × F [kN]

More guidelines / specifications / standards

Australia:

- SA TS 199:2023 “Design of geopolymer and alkali-activated binder concrete structures”

America

- ASTM C1948/C1948M-24 “Standard Specification for Alkali-Activated Cementitious Materials”

- ASTM C1928/C1928M-25e1 “Standard Test Method for Compressive Strength of Alkali Activated Cementitious Material Mortars

ASTM C2918

11.5 *Curing of Test Specimens:*

11.5.1 Curing is accomplished either using room temperature curing or using elevated temperature curing. The curing regime used is determined by the manufacturer. Curing procedures to be used are defined in 11.5.2 and 11.5.3.

11.5.2 *Room Temperature Curing*—Immediately upon completion of molding, place the test specimens in a room maintained at a temperature of 23.0 °C ± 2.0 °C [73.5 °F ± 3.5 °F]. The specimens shall be kept in the molds for 24 h wrapped in polyethylene plastic film or tightly sealed plastic bag to avoid moisture loss, then removed from the molds and wrapped in polyethylene plastic film again until they reach the desired test age.

SA TS 199

"Creep of Geopolymer and Alkali Activated Binder Concrete"

processes, enabling engineers to effectively utilise these novel concretes in practice.

The findings of this research underscore the inapplicability of design model codes developed for OPC concrete to non-traditional binder concretes. The study confirms that the SA TS 199 model provides accurate predictions for the tested design mixes, demonstrating its reliability and suitability as a valuable tool for engineers, an demonstrates calibration of the model for environmental, thickness and time of loading

Creep of Geopolymer and Alkali Activated Binder Concrete: Comparison with OPC Concrete and Design Codes

Gao et al. Sep. 2025

Concrete Institute of Australia (CIA) concrete conference 07.09-10.09 2025

There is no bad weather there is just bad clothes

Choose the right material for the right application!

AAC e.g. for:

- Aggressive environments (chemical)
  - E.g. pipes
- Tunnel segments
- Secondary concrete
- Ballast concrete

What is happening on larger scale?

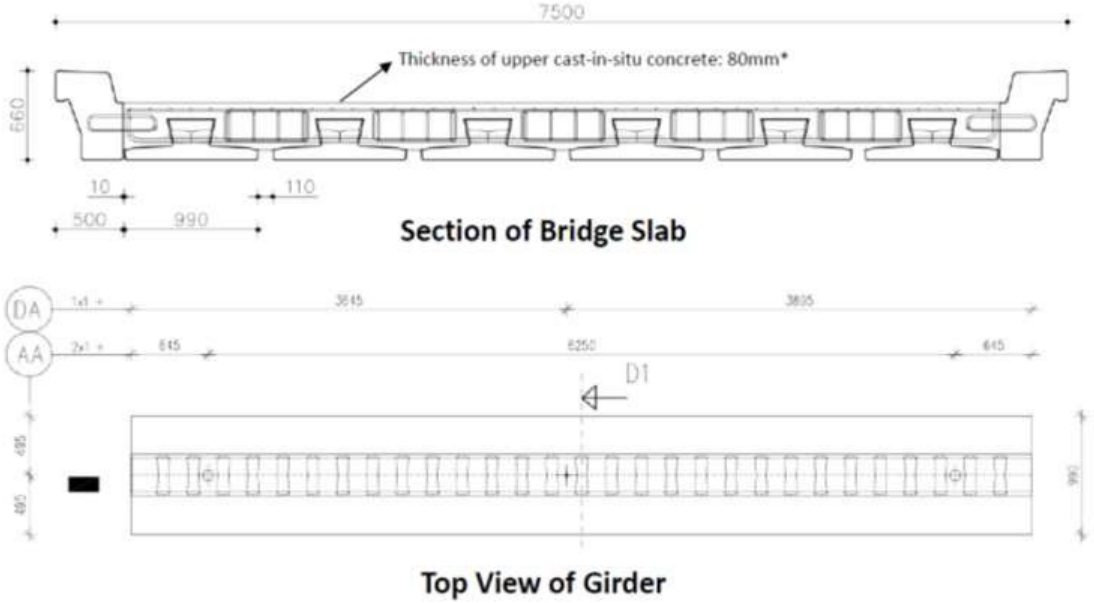
Webpage: https://geopolymerinternational.com/

What is happening on larger scale?

Webpage: https://sqape.nl/en/

What is happening on larger scale?

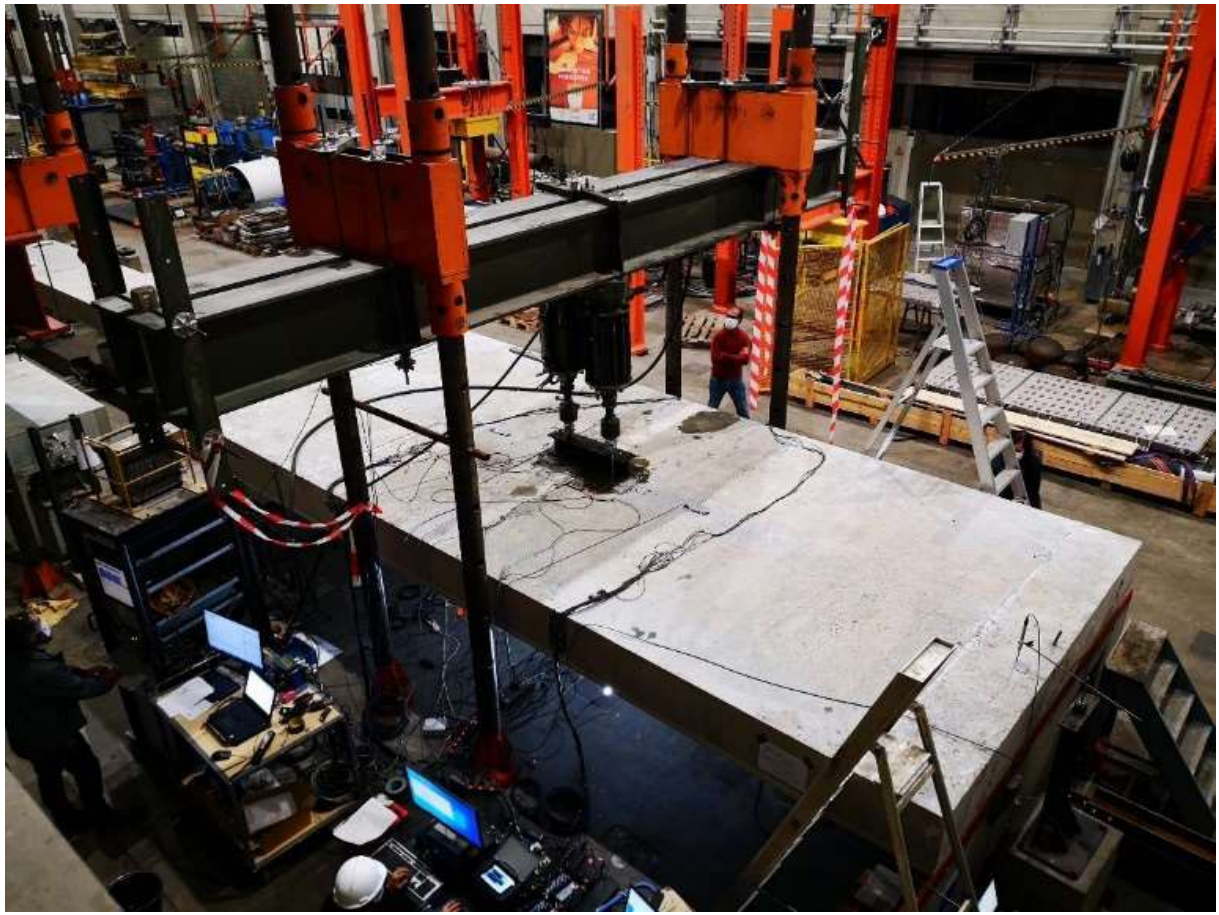
Kowebrêge, N358 Road in Friesland Province



Alkali Activated Concrete: From Design and Materials Properties to Structural Behavior and Engineering Application

“Applications by Dr. Vilma Ducman & Prof. Dr. Guang Ye & Dr. Majjda Pavlin, ZAG, TU Delft May 2025

What is happening on larger scale?



IBF A/S: Geoprime® solution used in sewage pipes in Denmark saves over 50% CO2

Project setup

Thank you for your attention

Feel free to contact me

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