# LOIKKA

## Accelerated CEM III/B strength development from laboratory to industry-scale

## LOPPUWEBINAARI – 29.4.2024

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# Agenda

- **Yritysesittely**
- **Projektin tavoite**
- **Materiaalit ja tutkimusmenetelmät**
- **Tulokset**
- **Seuraavat askeleet/lisätutkimustarpeet**

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# Reitti vihreään rakentamiseen

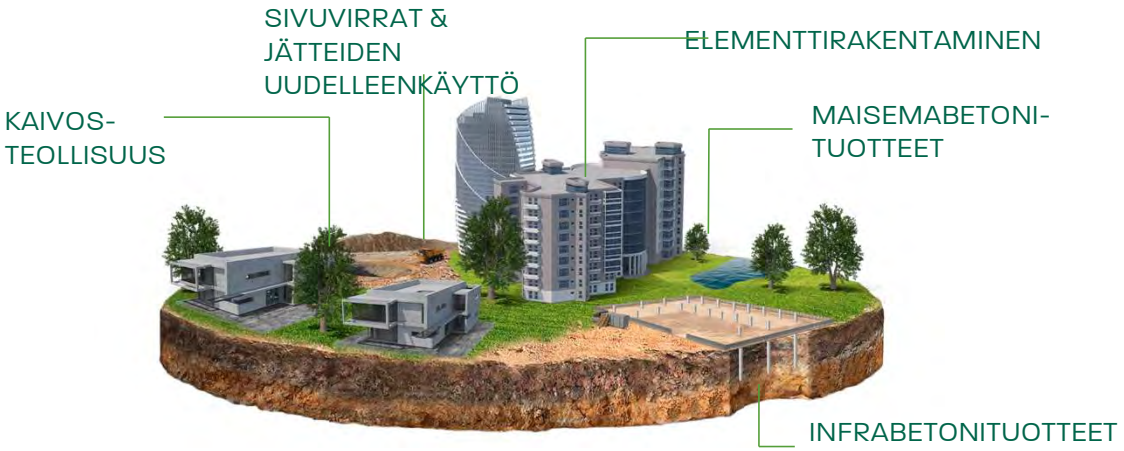
Betolar on suomalainen materiaaliteknologian yritys, jonka tavoitteena on vähentää CO2-päästöjä sekä neitseellisten luonnonvarojen käyttöä.

## >Geoprime® innovaatio

Geoprime® on Betolarin 100 % sementtivapaa materiaaliratkaisu, joka mahdollistaa betonin valmistuksen ilman sementtiä.

Betolar tarjoaa Geoprime® -ratkaisun lisenssisopimuksella betonivalmistajille. Lisenssi kattaa kaiken betonin reseptiikan hallinnasta tuotekehitykseen sekä tuotantoon siirtymiseen.

## >Asiakassegmentit




## >Meistä

Pääkonttori Suomessa, henkilöstöä >60

Vuodesta 2021 Nasdaq First North Growth Market – listalla

Päämarkkina-alueet: EMEA, Intia, SEAP, Lähi-itä

## Target

- Acceleration of CEMIII/B (commercial type)
- Strength Requirements made based on OIVA cement:

1. 1-day strength achievement (>15 MPa).
2. 28-days strength of >45MPa

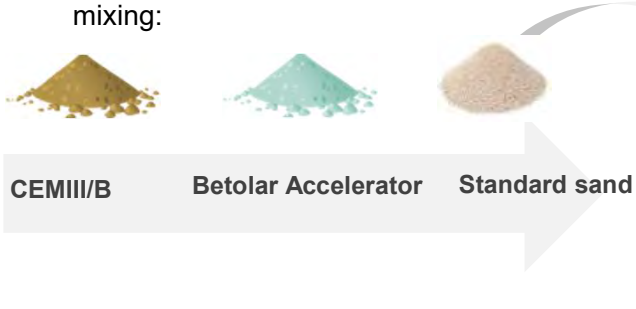
| Target Strength Achievement Like Oiva Cement | | | | |
|---|---|---|---|---|
| CEM Types | 1 D | 2 D | 7 D | 28 D |
| LPR OIVA | 14,11 | 24,97 | 40,06 | 50,56 |

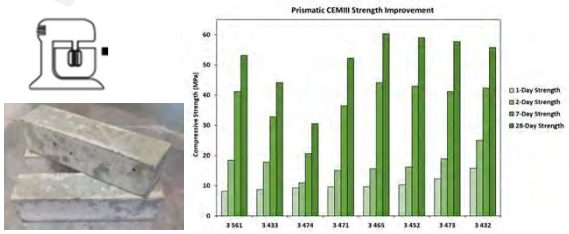
## Methods to address the target

- Activating CEMIII/B with different accelerators
- Strength development requirements at different curing conditions.
- Comparing the results of the commercial CEMIII/B and CEMIII/B made with mixing GGBFS and CEMI
- Checking properties related to large-scale mixing like air-%, workability and density

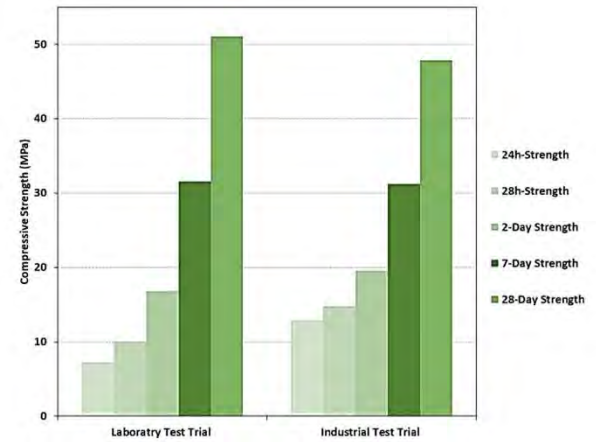
## Materials and Method

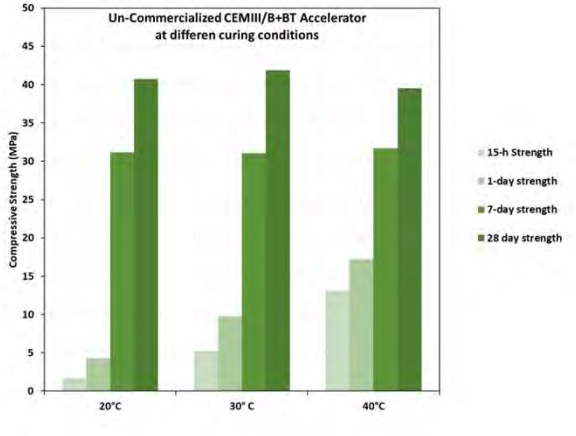
➢ Making prismatic samples based on the standards to get insights for the large-scale mixing:




➢ Making large-scale mixing (cubes) based on the best results from the prismatic-scale study
➢ Preparing for the industrial-scale test based on the large-mixing



# Pilot production for wall elements

| Industrial trial for wall elements | | |
|---|---|---|
| | CEMII+Betolar accelerator | CEMIII-Reference |
| Porakappaleet | MPa | MPa |
| 12h | 14,6 | 6,6 |
| 14h | 19,6 | 9,1 |
| 15h | 22 | 7,35 |
| 24h | 27,3 | 4,4 |
| | | |

- Curing Condition→ 40°C water circulation under the molds for 1 day and then moving to 20 °C

- **BT prototype helps the strength development specifically at elevated curing temperature and the role of this prototype helping the activation of Slag and cement together considering the compact structure and strength development**

# Durability test analysis

- **Freeze-thaw (*CEN/TR 15177*)→** Passed
- **Frost-salt resistance (*CEN/TS 12390-9* )→** needs further development
- **Carbonation→** Samples are exposed to an atmosphere containing 1 % CO2 at a temperature of (21 ± 2) °C and relative humidity (RH) of (60 ± 10) %. The carbonation depth is measured after 14 days and 1, 2, and 4 months. The samples were stored under laboratory conditions 14 days before the first measurements. Overall, the results for the CEMIII/B prototype are at the acceptable depth range as the reference. →Need further development
- **Sulphate resistance→** Passed
- **Sulphate Expansion (**RILEM AAR-3) → Passed

# Next Steps

- The effect of using different binder content must be studied considering strength, workability, and retention time.
- Additional modification studies could be carried out to improve workability, retention time, and strength development.
- Additional modification studies could be carried out for curing at low temperatures (<20 and <+/-5 °C)
- More durability-related studies need to be carried out – frost-salt resistance and carbonation
- Betolar prototype needs to be certified, and the action has already started and is in the process.

# KYSYMYKSIÄ

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