Reuse of fines particles from concrete recycling (< 63 µm) for the manufacture of compressed bricks.

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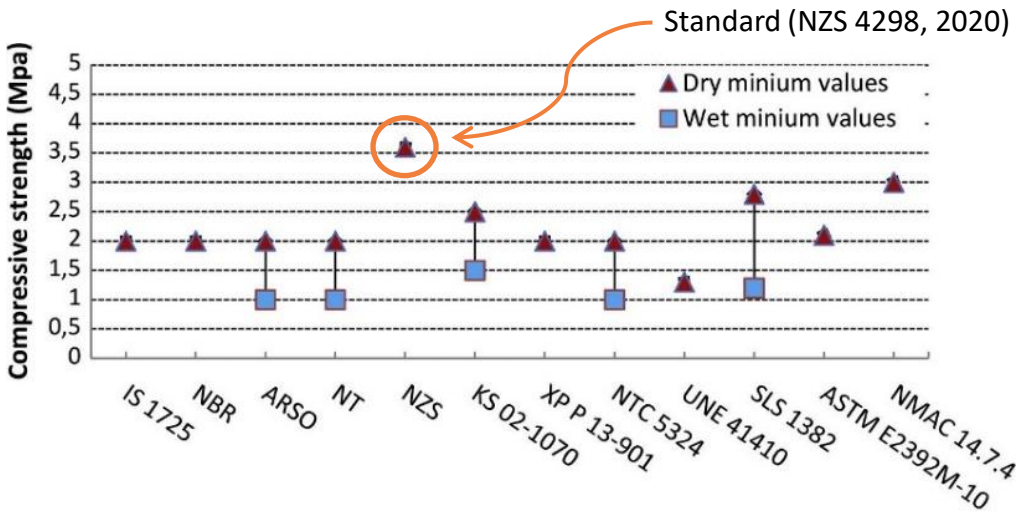
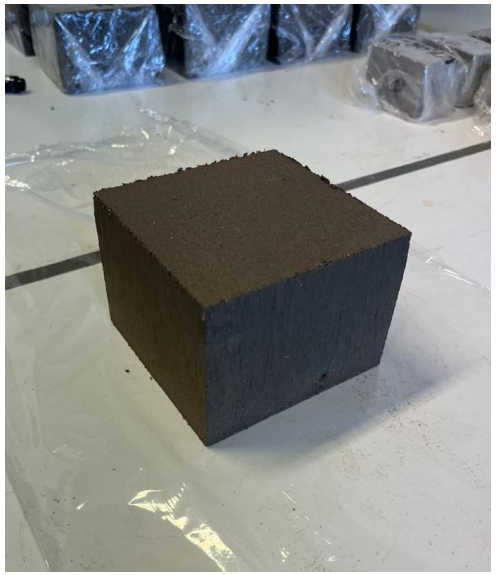
Objectives

Optimizing the **compressive strength** of the bricks while minimizing their **environmental impact** (< 10% cement) and **comparing** them to existing construction bricks/blocks.



Compressive strength standards for BTCs by country (1)



Compressed brick

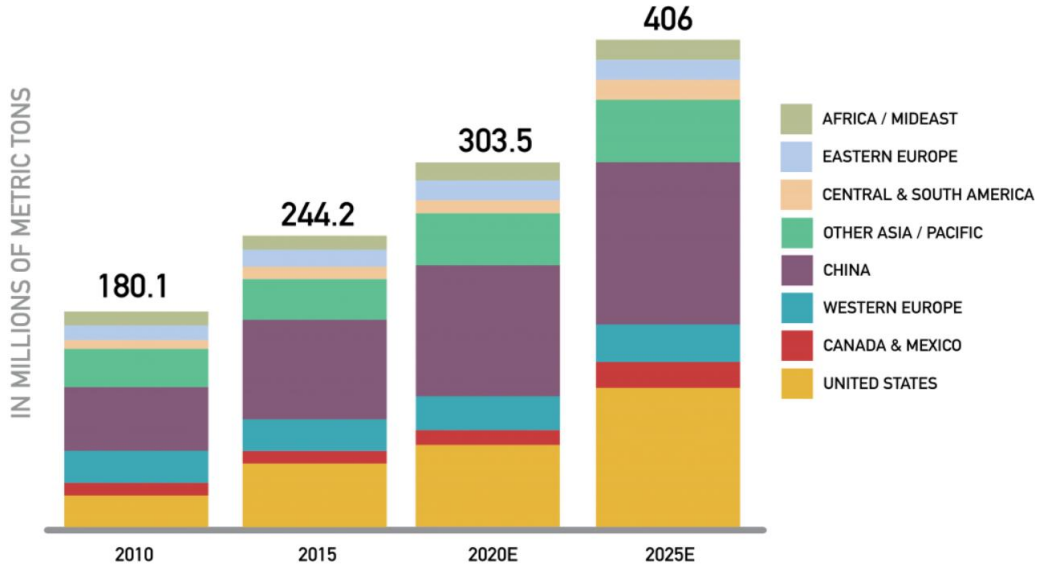
Manual press TESTARAM

- Minimum required : 3,5 MPa
- Target objective : 6 MPa (2)

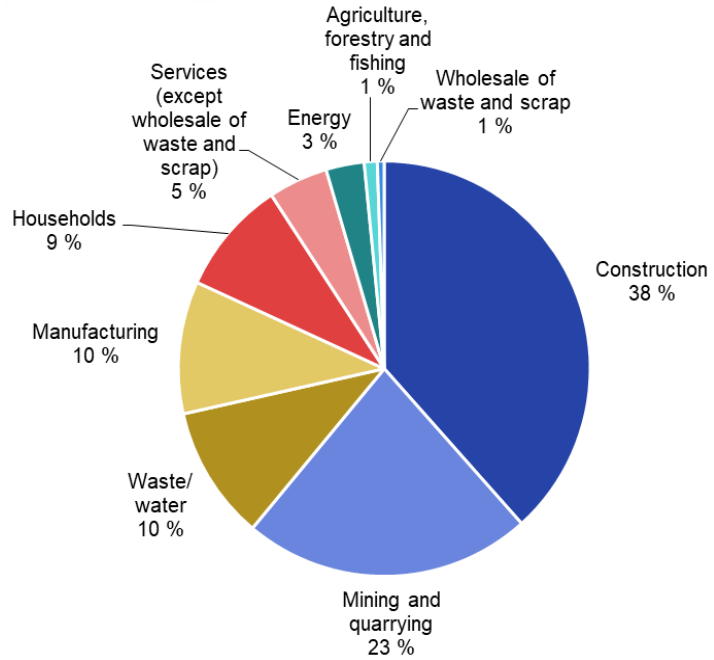
Applications :
Interior/Exterior walls and partitions

(1) Cid-Falceto et al. (2012). Assessment of compressed earth blocks made in Spain: International durability tests. Construction and building materials.
(2) XP P13-901 (2022). Catégorie RC6 de briques et blocs de terre crue pour murs et cloisons selon les normes européennes.

Context



Evolution of global demand for sand in millions of tons (3)



Breakdown of waste produced in the European Union by category (4)

Can we find alternative materials – and build a future less dependant on traditional ones?

(3) Courard & Bissonnette. (2025). Use of recycled sand and expansive agents for the production of more durable and sustainable cement-based materials.
(4) European Commission. (2018). Construction and demolition waste [WWW Document].

Materials and methods

Materials

- Unwashed mixed recycled sand (MRS 0/2)
- Soil fines (< 63 µm)
- CEM III/B 32,5 N

Fabrication process

- Mixing components
- Manufacturing bricks by compaction → 15 tons
- Curing under protective film for 28 days (23°C and 60% R.H.)

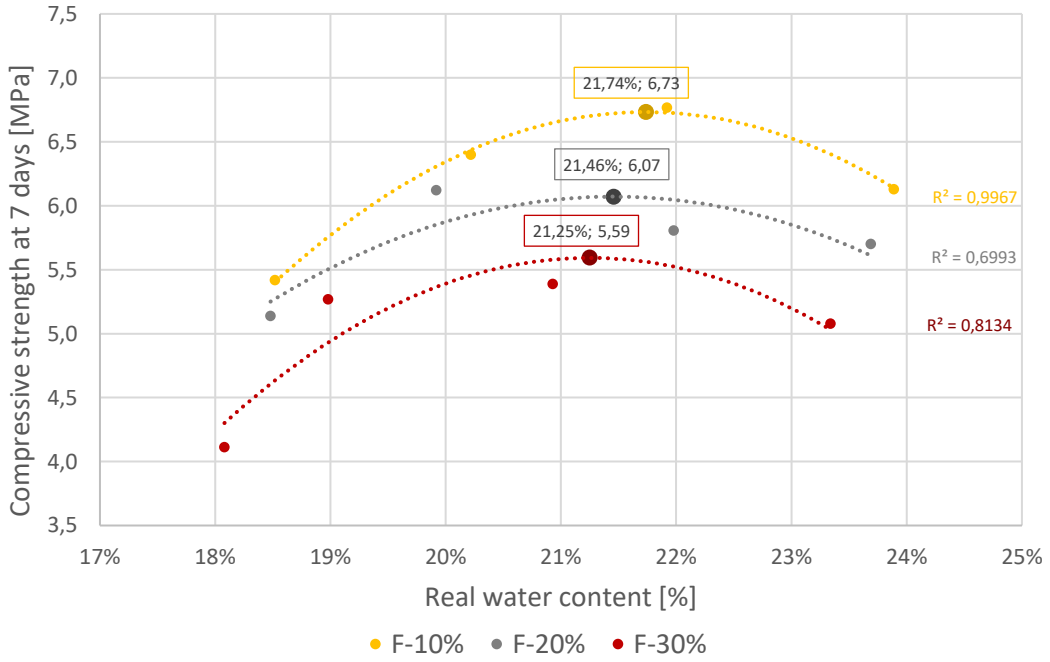
Bricks characterization

- Real water content of fresh mixes in the microwave
- Density after 28 days
- Compressive strength after 28 days
- Water absorption

Soil fines

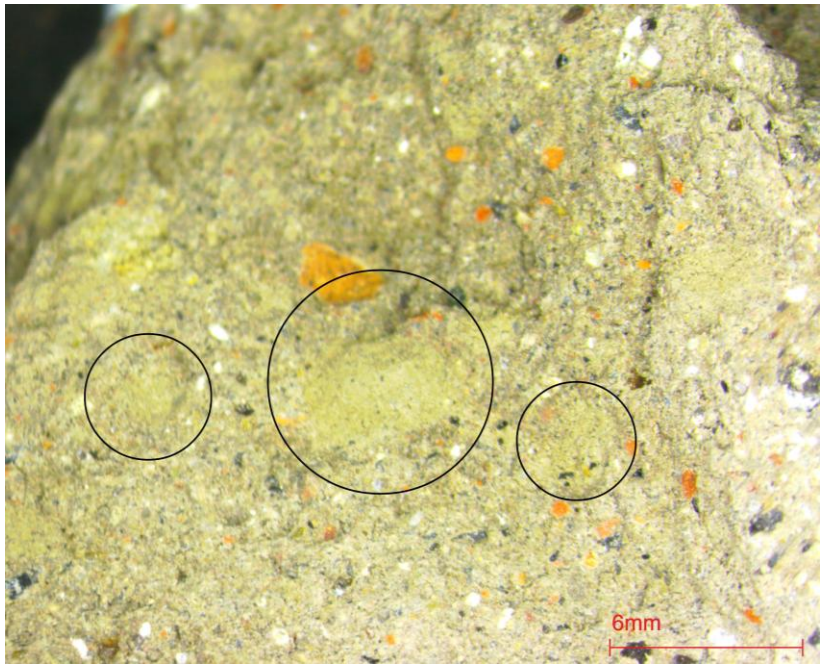
Results optimized mixes (10%, 20% & 30% of fines)

Optimal water content at 7 days



- Until F-30%, real compressive strength at 28 days increases with fines content
- Optimum fines content not reached yet
- After investigation, fines behave like aggregates

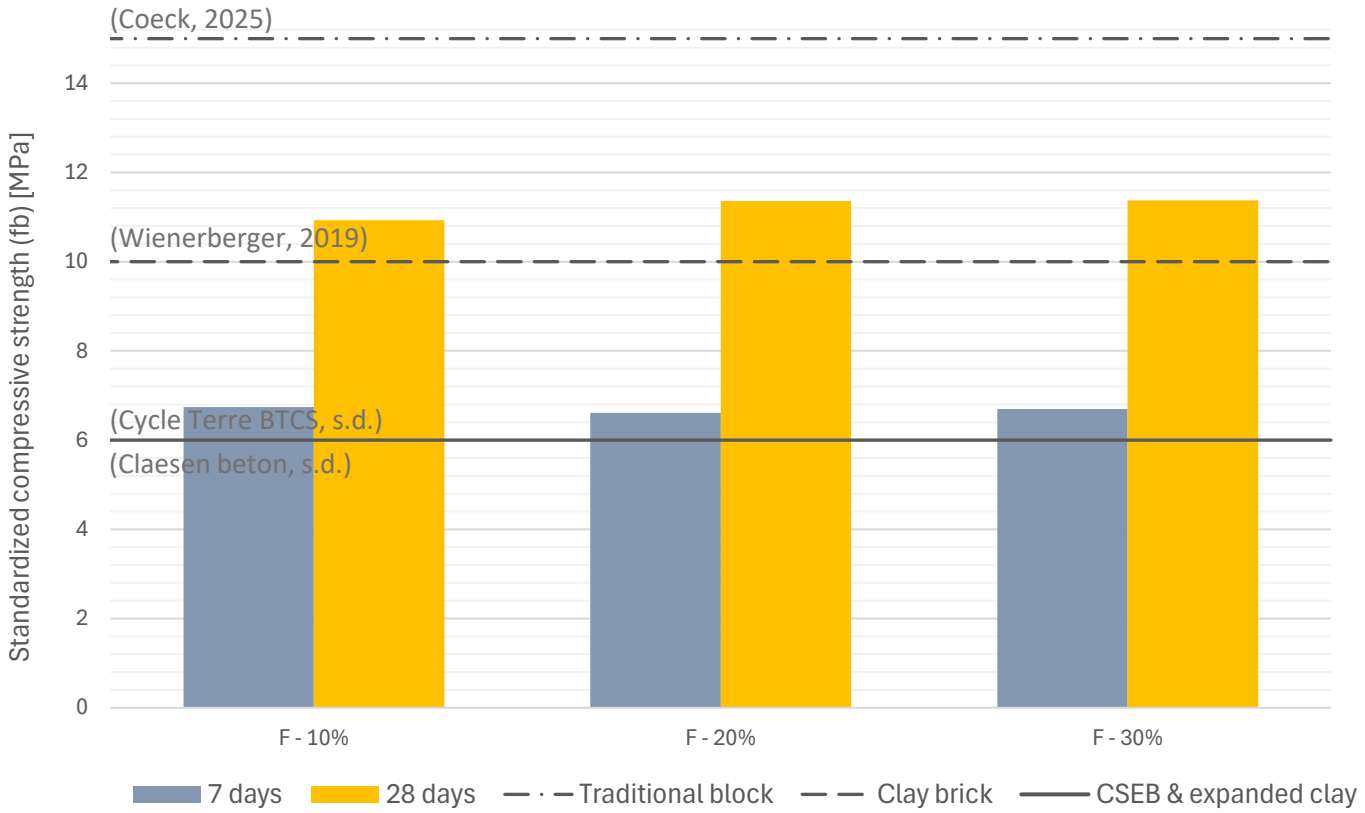
Fines content	σ 7d,th (MPa)	σ 7d,real (MPa)	σ 28d,th (MPa)	σ 28d,real (MPa)
F-10% ↓	6,73	6,75	11,34 ↓	10,82 ↑
F-20% ↓	6,07	6,67	9,94 ↓	11,37 ↑
F-30% ↓	5,59	6,91	9,16 ↓	11,61 ↑



Bricks microscopy

Results optimized mixes (10%, 20% & 30% of fines)

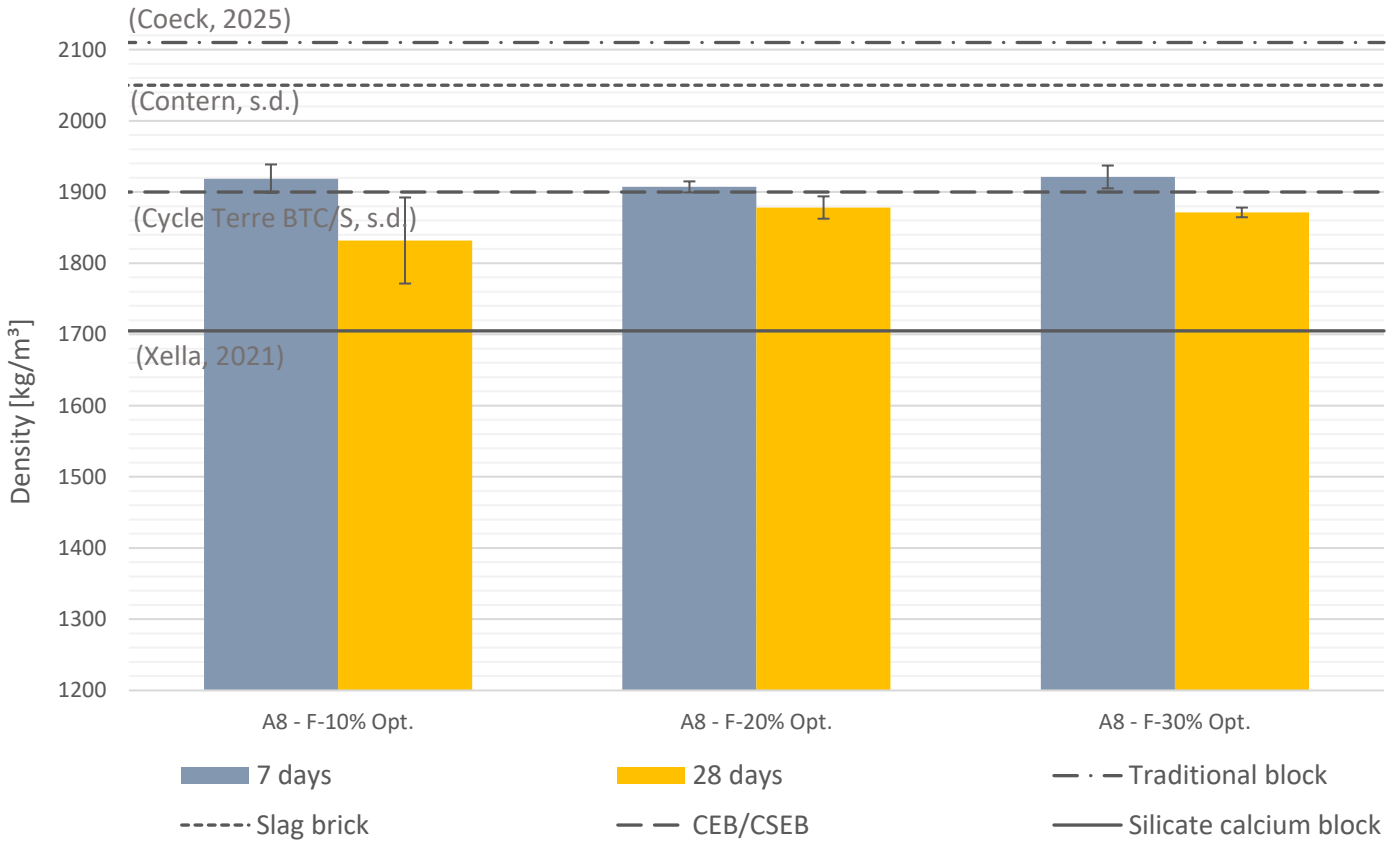
Compressive strength at 28 days (cement content : 180 kg/m³)



Type of brick/block	f_b (MPa)
AAC block	2 -> 5
CEB	4
CSEB & expanded clay	6
Clay brick	10
Compressed brick	±11
Traditional concrete block	15
Slag and silicate calcium brick	> 20

Results optimized mixes (10%, 20% & 30% of fines)

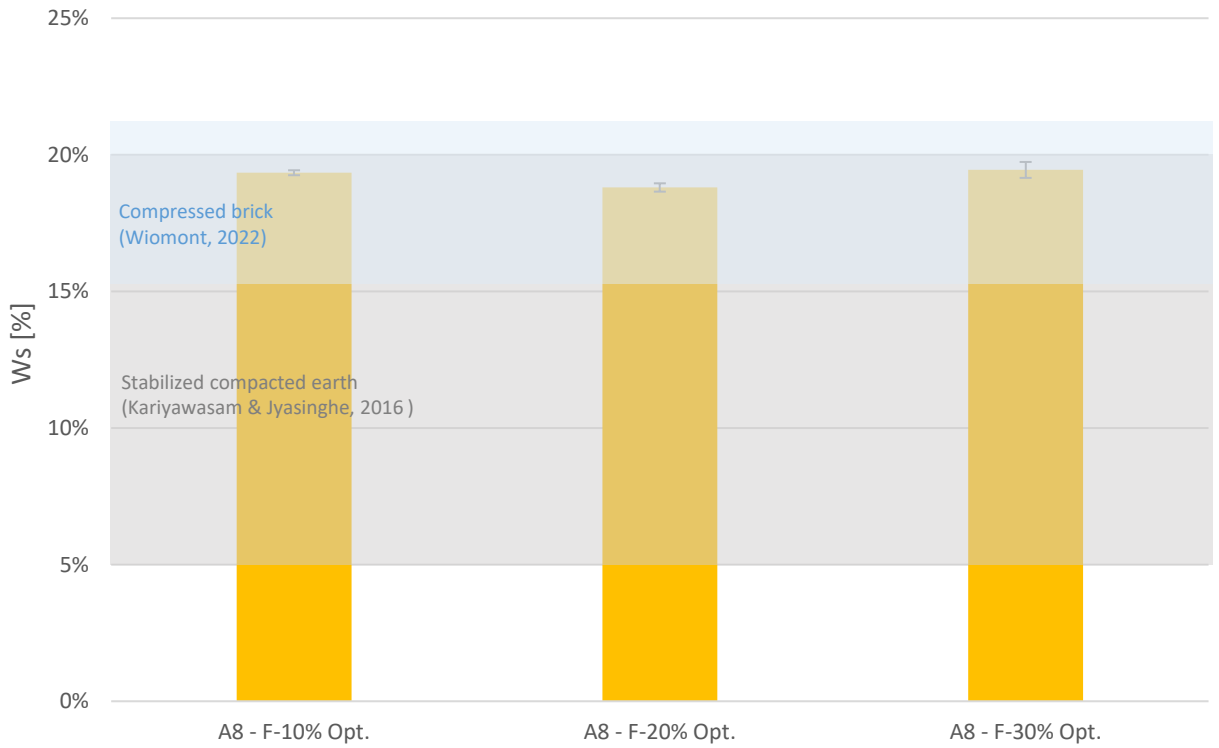
Density at 28 days



Type of brick/block	Density (kg/m³)
Calcium silicate block	1610-1800
Compressed brick	±1850
CEB/CSEB	1900
Slag brick	2050
Traditional concrete block	2110

Results optimized recipes (10%, 20% & 30% of fines)

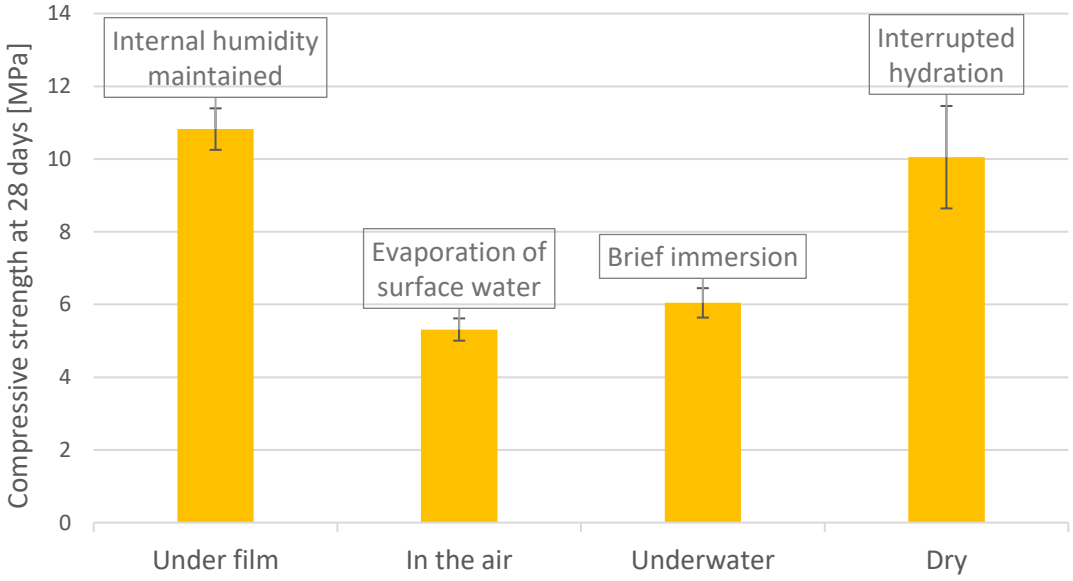
Water absorption at 28 days (cement content = 180 kg/m³)



- Main limitation of the material
- Compressed bricks absorb ≈19% water
- Still below Wiomont (2022)
- Suitable for indoor use or dry climates

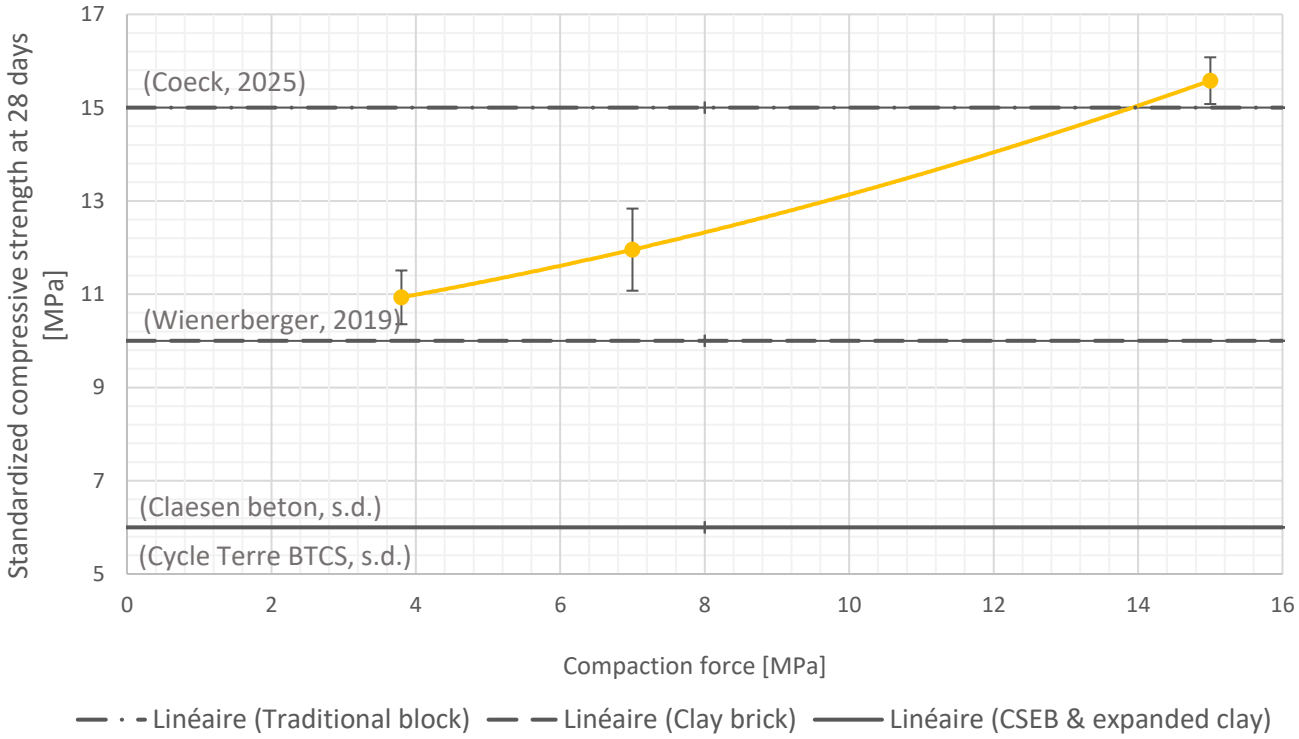
Results - Other parameters (10% of fines)

Curing mode



- **Under film curing → Best curing method**
- **In air → Water evaporation → Poor hydration of cement**
- **Underwater → Drop due to pore pressure**
- **Dry (105°C) → fast water loss → Stopping the end of hydration**

Compaction force



- **Higher compaction → higher strength**
- **Adding compaction could further improve the results**

Conclusion

Studying fire resistance

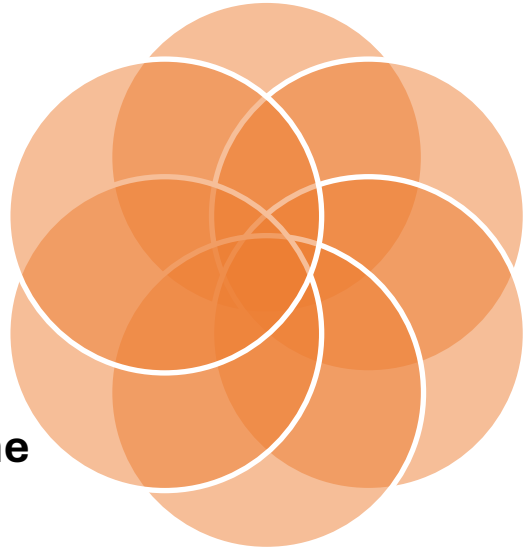
Reducing the environmental impact even more

Measuring thermal inertia

Doing a life cycle assessment

Understanding the microstructure of the bricks

Testing bricks assemblies



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Thank you!

Questions?

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