

Carbon-Smart Concrete Pavers: Bench-scale CO₂ Curing to Reduce Embodied Carbon and Improve Early Strength

ABSTRACT

Accelerated Carbonation Curing (ACC) enables concrete to capture CO₂ while improving early strength. This study evaluates ambient-pressure CO₂ curing for this precast concrete (pavers and cubes) using GPC, and GPC + 20% fly ash.

Specimens were exposed to CO₂ in a custom-built curing chamber for 4-24 hours. Mass gain was used as a proxy for CO₂ uptakes, and compressive strength is tested at 3 and 7 days

OBJECTIVES

- Design a low-cost CO₂ curing chamber
- Measure CO₂ uptake (mass gain)
- Compare compressive strength (3 & 7 days)
- Evaluate carbon reduction

ACKNOWLEDGEMENT

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- CACM
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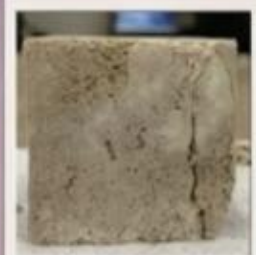
EXPERIMENTAL SETUP IMAGES



Curing



Testing



Cracking

EXPERIMENTAL SETUP

Materials

- OPC, and OPC + 20% fly ash
- w/c = 0.45
- 50 mm cubes / pavers, ≥ 3 samples per condition

Curing Conditions

- Ambient moist core, 23°C ≥ 95% RH, ACC - 4, & 24 hrs CO₂ exposure
- Vented chamber with CO₂ pulse every 20 min -> ACC

KEY EQUATIONS

- CO₂ Uptake = $\frac{\text{Post mass} - \text{Pre mass}}{\text{Load} / \text{Area}}$
- Strength = $\frac{\text{Load}}{\text{Area}}$
- Net Carbon = Emissions - CO₂ captured

SAFETY

- Never pressurize chamber
- CO₂ is an asphyziant = ventilated operation
- Use PPE (gloves, goggles)

CONCLUSION

- ACC of concrete pavers shows great promise to reduce embodied carbon while improving early strength.
- For SCMI, ACC increased 3-day compressive strength by X% and took up Y g CO₂/g binder

CONCRETE BLUEPRINT

Compound	Average Amount Used. (gm)
Sand	1125.0 gm
Cement	314.8 gm
Water	206.3 gm
Rocks	225 gm
Fly Ash	135 gm

