CARBCOMN

Carbon-negative compression dominant structures for decarbonized and deconstructable concrete buildings

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AMBITION

Our ambition is to foster decarbonized construction for load-bearing concrete buildings and infrastructure, utilizing 3D-printed blocks made from carbon-curing concrete formulations, assembled into compression-dominant structural systems.

TEAMING UP

The consortium brings together 5 research institutes and 6 companies, to excel in science and exploitation of carbon-curing concrete, concrete 3D printing, shape memory alloys, structural geometries that are compression dominant, digital design-to-manufacturing pipelines for Architecture, Engineering and Construction (AEC) and life cycle analysis.

EIC CHALLENGE

CARBCOMN acts on a challenge put forth by the European Innovation Council (EIC). We are part of a portfolio of 10 projects that aim to develop breakthrough innovations in the triad of materials, design and fabrication for the AEC value chain.

ABOUT CARBCOMN

CARBCOMN is a European research initiative pioneering carbon-negative, compression-dominant construction systems using 3D-printed concrete blocks that sequester CO_2 during curing. By integrating advanced digital design tools, recycled materials, and modular, deconstructable geometries, the project aims to revolutionize sustainable building practices and drastically reduce embodied emissions. This research initiative, being an EIC Pathfinder project, is receiving funding from the European Union's Horizon Europe research and innovation programme.

WHY CARBCOMN

Greenhouse gas emissions from material extraction, manufacturing of construction products, as well as construction and renovation of buildings are estimated at 5-12% of the global footprint. Concrete, as we know it today, is one of the most relevant construction materials in terms of carbon footprint, raw materials usage and structural usage. Huge amounts of greenhouse gas are emitted during concrete production, mainly because of the high calcination temperatures needed to produce cement clinker and to decarbonize limestone. Also, 1 m^3 of concrete requires 2,6 tons of construction minerals, so that concrete construction accounts for about 50% of all material extracted for. Climate-neutral concretes and applications are a global research theme of high interest, but none of the current concepts have a full net-zero-carbon impact, because they bring partial

Greenhouse gas emissions of the construction sector are estimated at 5-12% of the global footprint

and mostly fragmented solutions that cannot stand up to the technical demands of AEC. CARBCOMN's ambition is to develop a disruptive design-to-fabrication technique based on carbo-negative concrete in innovative structural concepts, to unleash their sustainability potential for building and construction.

TECH TERMS EXPLAINED

CARBON MINERALIZATION

Carbon mineralisation is a chemical reaction between a carbonatable mineral powder and carbon dioxide in the presence of moisture, forming stable carbonates. The carbon dioxide becomes a solid material. Applied to concrete, called carbon-curing concrete, the latter becomes carbon negative.

COMPRESSION DOMINANT STRUCTURES

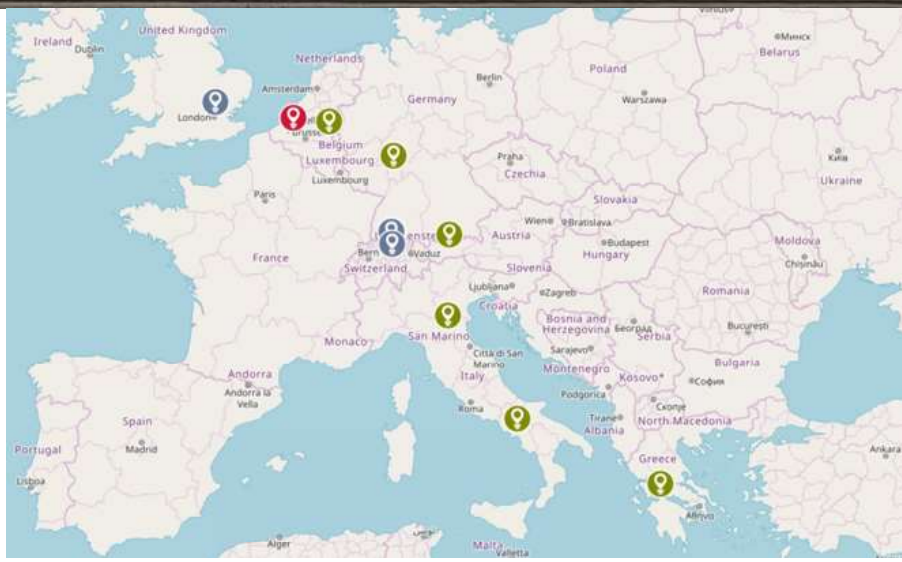
Compression dominant structures are a broad classification, encompassing essentially any load bearing structural system that induces a compression dominant stress state: (i) via simple (e.g. column) or more complex funicular (e.g. arches, domes) geometries; (ii) combined with normal forces present (e.g. dead loads) or additionally introduced via prestressing (e.g. via a post-tensioning).

CARBON NEGATIVE

Carbon-negative represents a deeper level of sustainability where an entity absorbs or removes more carbon dioxide than it releases.

THE CARBCOMN TEAM

The team brings together world-leading research and business expertise to pioneer a new era of carbon-negative construction. Comprising 11 cross-disciplinary groups from academic institutions and industry partners across 7 European countries, the consortium is united by a shared vision: to revolutionize concrete construction through digital innovation, sustainability, and circularity. The team holds a unique focus on 'strength through geometry' and 'circular construction', to achieve compression-dominant structural systems made from 3D-printed carbon-curing concrete blocks. This collaborative effort not only advances cutting-edge technologies but also lays the groundwork for real-world applications and future exploitation in sustainable building practices.



COORDINATOR ACADEMIC INSTITUTION INDUSTRY PARTNER

WORD FROM THE CARBCOMN COORDINATORS

Prof. Stijn Matthys and Prof. Kim Van Tittelboom, Ghent University

"Dear reader,

Welcome to the first CARBCOMN newsletter! In this edition, we introduce you to our European research initiative focused on developing compression-dominant structural systems using 3D-printed blocks made from carbon-curing concrete. Be inspired by the passion of the CARBCOMN consortium as we push the boundaries of eco-friendly concrete technologies. We are committed to advancing construction methods that align technological innovation with both economic viability and environmental responsibility.

Curious about how these cutting-edge concrete solutions could shape your next building project? Get in touch—we'd love to explore the possibilities with you."

LOOKING BACK TO KICK-OFF MEETING GHENT

On 8 and 9 October 2024 Ghent University invited all consortium partners to the CARBCOMN kick-off meeting in the city of Ghent. Next to laying out the foundations for sound management of the project, the technical work and specific tasks were discussed in detail and aligned with the overall ambitions. To foster mutual learning amongst the participants Prof. Phillipe Block (ETH Zürich) provided an expert talk on the subject of Disrupting Concrete Construction.

The coordinating team also organized a visit to the Magnel-Vandepitte laboratory of UGent. Here, the consortium partners participated in a speed course on concrete 3D-printing, including both theoretical and experimental sessions, gaining insights into its opportunities and challenges in materials, processes and applications.

STAY TUNED

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