

Advancing Low-Carbon and Sustainable Construction: Structural and Environmental Evaluation of Carbon Capture and Utilization (CCU) Concrete

Can Captured Carbon dioxide (CO₂) Help Build Greener Infrastructure? Exploring a new way to reduce the carbon footprint!

What is the project about?

CO₂ captured from industrial sources remains underutilized and is often treated as a waste product. Concrete is one of the most widely used construction materials in the world. This project explores whether captured CO₂ can be safely and effectively used in concrete production, transforming a greenhouse gas into a valuable resource for more sustainable construction.

Who is involved?

The project is led by Dr. Priyanka Bhartiya of COWI India Ltd. and Prof. Rahul Bhartiya of the Department of Civil Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad, one of India's leading engineering institutions. Together, the team combines industry expertise and academic research to explore the use of captured CO₂ in concrete and develop more sustainable construction solutions.

Where and when will it take place?

The research will be carried out at IIT (ISM) Dhanbad in India over a three-year period. Laboratory testing and environmental assessments will be conducted throughout the project.

How will it be done?

The project will develop a laboratory-scale concrete mixer that allows captured CO₂ to be injected into fresh concrete to produce Carbon Capture and Utilization (CCU) Concrete. Different mixing conditions (pressure, mixing time, mixing speed) will be tested to identify the most effective way of incorporating CO₂ into the concrete mix. The resulting CCU concrete will then be evaluated for its strength, durability, and long-term performance. Finally, its environmental impact will be compared with that of conventional concrete to assess the potential carbon savings throughout its life cycle.



Figure 1: Overview of the project activities and expected outcomes

Why is this important?

The construction industry uses enormous quantities of concrete every year, while large amounts of captured CO₂ remain underutilized. If captured CO₂ can be safely incorporated into concrete, it could help reduce emissions while maintaining the safety and durability of buildings and infrastructure. This would support the transition towards more sustainable and climate-friendly construction practices.

What happens next?

The project aims to provide practical guidance for engineers, contractors, and infrastructure owners on the use of CCU concrete. The findings will be shared through publications, training activities, and industry engagement. In the long term, the research could support the wider adoption of construction materials that help reduce carbon emissions while delivering safe and durable infrastructure.