

Low-Carbon Concrete



Technology Overview

Manufacturing cement, the binder required to make concrete, is responsible for 8% of global greenhouse gas emissions.¹ The most common type, ordinary portland cement, is made by grinding limestone and then heating it with sand and clay in fossil-fueled kilns. Carbon dioxide is released in two ways: from burning fossil fuels (typically coal) and from gases released by the limestone. The kilns need to reach temperatures of 1450°C, making an electric-powered process currently impossible.

Low-carbon concrete uses rocks or industrial byproducts to replace limestone and an electric-powered pulverization process or electrochemical process rather than kilns and fossil fuels. Low-carbon concrete matches or exceeds the strength of conventionally produced concrete and can be worked with in exactly the same ways. No special tools or techniques are required and it can be used for any structural component in any climate condition.

Why is GSA Interested?

Because concrete is a widely used construction material, low-carbon concrete can play a key role in the decarbonization of buildings. About 1 ton of CO₂ is saved from the atmosphere per 1 ton of binder used. Some compositions of low-carbon concrete also absorb CO₂ from the air, saving additional greenhouse gas emissions.

Industrial waste of all kinds can replace limestone and be saved from the landfill, including byproducts from steelmaking, kiln ashes and demolished concrete. Some usable elements can also be extracted from the electrochemical activation process and saved for other industrial applications.

Deployment Potential

Low-carbon concrete seamlessly integrates with existing industry standards, requiring no changes to building codes nor construction practices. It can be used wherever conventional concrete is used, including retrofits, new buildings, or sidewalks. Low-carbon concrete meets ASTM C1157 industry standard requirements, allowing architects and engineers to easily specify low-carbon concrete in their projects under existing building codes.

¹ RMI. "With Concrete, Less is More." <https://rmi.org/with-concrete-less-is-more/#:~:text=While%20essential%20to%20building%20the,%C2%B0C%20warming%20carbon%20budget.,> accessed 09-2024.

Green Proving Ground (GPG), in collaboration with the U.S. Department of Energy, is evaluating the real-world performance of low-carbon cement in federally owned buildings within GSA's inventory. The technology will be provided by C-Crete Technologies and Sublime Systems and coordinated with other ongoing evaluations of this technology.