



Low Embodied Carbon Bio-Concrete

Technology Overview

Cement production involves a process called pyroprocessing, where a mineral mixture is heated at high temperatures to create concrete. This method is carbon-intensive and a major contributor to greenhouse gas (GHG) emissions globally.¹ In 2022, the U.S. produced an estimated 95 million metric tons (MMT) of cement, emitting nearly 70 MMTs of CO₂, the highest production volume recorded between 2010 and 2022.²

To address this environmental concern, low embodied carbon bio-concrete technology introduces a biologically derived alternative to ordinary Portland cement (OPC). This innovation replaces carbon-intensive pyroprocessing with a specialized process that uses enzymes and bacteria to grow durable cement at ambient temperatures. Specifically, a ureolytic microbial system is employed to create calcium carbonate biocement, creating a strong, durable, low-carbon cementitious binder.

Why is GSA Interested?

This technology functions much like standard cement but significantly reduces greenhouse gas emissions in the production process. According to the manufacturer, it has the potential to cut CO₂ emissions from cement production by up to 85% compared to traditional methods. These pavers, akin to precast concrete, are resistant to stains, environmentally friendly (LBC Red list Free³), and boast a lifespan of over 30 years with minimal maintenance requirements.

Deployment Potential

The precast concrete-like pavers are applicable for non-structural interior or exterior applications, such as 2" exterior pedestrian pavers and ¾" wall tiles.

¹ Carbon dioxide emissions from the manufacture of cement worldwide from 1960 to 2021, <https://www.statista.com/statistics/1299532/carbon-dioxide-emissions-worldwide-cement-manufacturing/>, accessed 05-2023.

² Cement production in the United States from 2010 to 2022, <https://www.statista.com/statistics/219343/cement-production-worldwide/>, accessed 05-2023.

³ International Living Future Institute: About the Red List, <https://living-future.org/red-list/>, accessed 05-2023.

Green Proving Ground (GPG), in collaboration with the U.S. Department of Energy, is evaluating the real-world performance of Low Embodied Carbon Bio-Concrete in federally owned buildings within GSA's inventory. The technology will be provided by Biomason and coordinated with other ongoing evaluations of this technology.