

innovative design practices to reduce the carbon emissions using 3DCP.

Reducing carbon emissions in 3D concrete printing

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Concrete 3D printing (3DCP) is a breakthrough construction technology that is touted to enhance the environmental sustainability of the production of concrete elements. This can be achieved by (1) elimination of formworks (2) innovative design practices for 3DCP, and (3) use of eco-friendly printable concretes. In this study, the authors analysed the effects of these technical processes on reducing the carbon emissions in the 3D printed concrete elements. The development and use of 3D printable eco-friendly ultra-high performance concrete (3DP-E-UHPC) demonstrate the combined effects of these processes on reducing the emissions. Due to the high strength and ductility of 3DP-E-UHPC, the designs of 3DP-E-UHPC elements can have slender cross-sections. Building thin sections reduces the total use of concrete in the printed elements, thereby reducing the carbon emissions. Meanwhile, the use of supplementary cementitious materials in the production of 3DP-E-UHPC further draws down the carbon emissions. In this study, the carbon emissions of the concrete elements made of 3DP-E-UHPC were measured by calculating their global warming potentials based on material ingredient use and cross-section sizes. The outcomes were compared against those of the elements made using conventional methods (with formworks), and conventional concretes. The results indicated the importance to promote the development of sustainable mixtures and