

## Development of Sustainable Cement Based Material for Additive Manufacturing

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This paper presents experimental results on the optimization of sustainable cement-based mix for additive manufacturing techniques. An extrusion-based 3D Cement Printing (3DCP) machine was modified for the experiment according to the requirement. Cement-based mix was designed and tested for the printing process. A mix design was tested for the fresh properties of the mix: extrudability, flowability, workability, buildability and open time. The printing machine and parameters were enhanced to achieve the required properties of the printing process. The potential of enhancing sustainability of the mix was investigated by reducing the carbon footprint of the process. Supplementary cementitious materials (SCMs) such as fly ash and silica-fume were considered as environmentally friendly materials to add as a portion of binder to the mix. This experiment yielded in mixing fly ash and silica fume to replace conventional binder proportionally, successive in fresh properties. The effect of additives in the cement mic was observed.

**Keywords:** *3DCP, Additive manufacturing, Mix design, optimized concrete mix design, Sustainability, Printing parameter.*