# 3D-printing development of low carbon building materials

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**Abstract.** 3D printing of building materials is promised to large uses in a near future, and to a first instance to produce custom-made pieces, prototypes and small productions. Dealing with concrete, 3D printing is also faces challenging projects using less material, more complex shapes and extensions to larger scales. Furthermore, careful selection of concrete's raw materials allows an environmental impact reduction together with a proper adjustment of rheological properties. In this work, mixtures are developed to satisfy properties in fresh and hardened states of specimen printed layer by layer.

Multiple tests allow the determination of the printability by the extrusion 3D printer system, such as rheological evaluation, extrudability, pumpability, buildability or printability window. The goal is to obtain the mixture with the best fresh behavior for printability.

To reduce the carbon footprint of cement, a large part of stoneware powders is substituted for cement and the new mix is optimized for 3D printing. The impact of stoneware powders on selected printability properties, is studied to obtain in 3D printing, behavior and durability performances equivalent to casting samples. In addition, in the hardened state, printed samples must keep targeted shapes, proportions, and properties. The influence of lamination or mixture components are evaluated using mechanical strength and durability tests.

**Keywords:** 3D printing, Mixture, Printability, Mortar, Stoneware.