Evaluation of Durability of 3D-Printed Cementitious Materials for Potential Applications in Structures Exposed to Marine Environments

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Abstract

The rising interest in 3D-printing of concrete structures for use in marine environments requires development of concrete mixtures with adequate mechanical and durability characteristics. The incorporation of alternative cementitious materials, combined with careful selection of printing parameters has emerged as an effective way of controlling not only the fresh properties and printability of mixtures, but also their mechanical and durability properties. This paper presents the results of various durability related tests performed on 3D-printed mortars, including density, porosity, rate of water absorption and resistance to chloride penetration. Results of these tests indicate that the performance of mortar elements 3D-printed using controlled overlap process was similar to the performance of conventionally cast mortar elements with the same composition. Moreover, the results of the chloride transport related tests obtained from all specimens evaluated during the course of the study indicate low chloride ion penetrability, thus re-affirming

that combination of the proposed material and 3D-printing method of fabrication have a potential for producing structural elements for applications in marine environments.