Convective Concrete

Additive Manufacturing to facilitate activation of thermal mass

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Convective Concrete – Additive Manufacturing to facilitate activation of thermal mass*

Dennis de Witte[1], Marie L. de Klijn-Chevalerias[2], Roel C.G.M. Loonen[3], Jan L.M. Hensen[4], Ulrich Knaack[5], Gregor Zimmermann[6]

1 Corresponding author [MSc. D. (Dennis) de Witte] Design of Construction, Delft University of Technology, P.O. Box 5043, 2600 GA DELFT, The Netherlands, +31 (0)15 27 84094, d.dewitte@tudelft.nl – Institute of Structural Mechanics and Design, Technical University Darmstadt, Franziska-Braun-Straße 3, 64287 DARMSTADT, Germany, +49 6151 16 23035 dewitte@ismd.tu-darmstadt.de

2 MSc. M.L.(Marie) de Klijn-Chevalerias] Unit Building Physics and Services, Eindhoven University of Technology, P.O. Box 513, 5600 MB EINDHOVEN, The Netherlands, +31 (0)40 247 2577, m.l.d.klijn@tue.nl

3 [ir. R.C.G.M. (Roel) Loonen] Unit Building Physics and Services, Eindhoven University of Technology, P.O. Box 513, 5600 MB EINDHOVEN, The Netherlands, +31 (0)40 247 2571, r.c.g.m.loonen@tue.nl

4 [Prof.Dr.ir. J.L.M. (Jan) Hensen] Unit Building Physics and Services, Eindhoven University of Technology, P.O. Box 513, 5600 MB EINDHOVEN, The Netherlands, +31 (0)40 247 2988, j.hensen@tue.nl

5 [Prof. Dr.-Ing. U. (Ulrich) Knaack] Design of Construction, Delft University of Technology, P.O. Box 5043, 2600 GA DELFT, The Netherlands, +31 (0)15 27 84094, u.knaack@tudelft.nl - Institute of Structural Mechanics and Design, Technical University Darmstadt, Franziska-Braun-Straße 3, 64287 DARMSTADT, Germany, +49 6151 16 23013 knaack@ismd.tu-darmstadt.de

6 [Dr.-Ing. G (Gregor) Zimmermann] G.tecz engineering GmbH, Angersbachstraße 12b 34127 KASSEL, Germany, +49 561 86 17 555, contact@gtecz.com

Abstract

This paper reports on the research-driven design process of an innovative thermal mass concept: Convective Concrete. The goal is to improve building energy efficiency and comfort levels by addressing some of the shortcomings of conventional building slabs with high thermal storage capacity. Such heavyweight constructions tend to have a slow response time and do not make effective use of the available thermal mass. Convective Concrete explores new ways of making more intelligent use of thermal mass in buildings. To accomplish this on-demand charging of thermal mass, a network of ducts and fans is embedded in the concrete wall element. This is done by developing customized formwork elements in combination with advanced concrete mixtures. To achieve an efficient airflow rate, the embedded lost formwork and the concrete itself function like a lung. The convection takes place with separate pipes on both sides of the concrete's core to increase the charge/discharge of the thermal storage process. The first stage of the research, described in this paper, is to simulate the Convective Concrete at the component level, whereupon a mock-up is tested in a climate test set-up. The paper concludes with describing planned activities for turning this concept into a real building product.

Keywords

concrete, thermal mass activation, computational design support, Additive Manufacturing, advanced formwork, optimization, heat exchange, heat storage

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