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Bruno Dal Lago, S.U.E. Taylor, Peter Deegan, Liberato Ferrara, Mohammed Sonebi, Philip Crosset, Andrea Pattarini

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COMPOSITES PART B: ENGINEERING

FULL-SCALE TESTING AND NUMERICAL ANALYSIS OF A PRECAST FIBRE REINFORCED SELF-COMPACTING CONCRETE SLAB PRE-STRESSED WITH BASALT FIBRE REINFORCED POLYMER BARS

BRUNO DAL LAGO[1*], SU E. TAYLOR[2], PETER DEEGAN[3], LIBERATO FERRARA[1], MOHAMMED SONEBI[2], PHILIP CROSSET[2], and ANDREA PATTARINI[4]

[1] Department of Civil and Environmental Engineering, Politecnico di Milano, p.za Leonardo da Vinci 32, 20133 Milano, Italy

[2] School of Natural and Built Environment, Queen's University, University Road, BT7 1NN Belfast, Northern Ireland, UK

[3] Banagher Precast Concrete, Queen Street, Banagher, Republic of Ireland

[4] Azichem, via Gentile 16a, Goito (MN), Italy

* Corresponding author: brunoalberto.dallago@polimi.it

Abstract

Steel-free pre-stressed reinforced concrete may be used in aggressive environments to increase the durability of structural elements and to limit the carbon footprint by replacing steel with high-strength fibre composites. The design of a 10-m long steel-free precast fibre-reinforced concrete slab, pre-stressed with basalt-fibre reinforced polymer (BFRP) bars and shear-reinforced with glass-fibre reinforced polymer bars, is presented in this paper. Non-linear viscoelastic and elastic-plastic models have been employed for the prediction of the service and ultimate limit state flexural behaviour, respectively. Preliminary tests on the employed materials and a 3-point load test on the slab element are presented, together with indications on its manufacturing process. The proposed numerical analysis is validated against the experimental results.

Keywords: Steel-Free beams; Fibre Reinforced Self-Compacting Concrete (FRSCC); Basalt Fibre Reinforced Polymer (BFRP) Bars; Creep Losses; Visco-Elastic Analysis; Non-Linear Analysis.