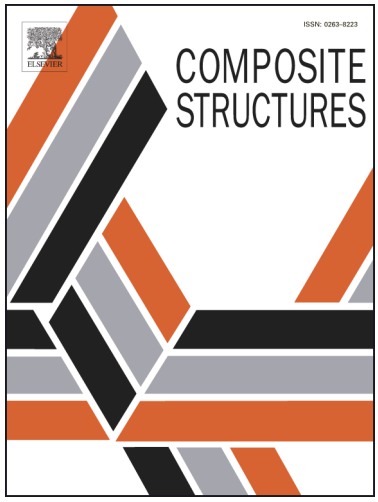
Journal Pre-proofs



Compressive behaviour of concrete-filled carbon fiber-reinforced polymer steel composite tube columns made of high performance concrete

Krzysztof Ostrowski, Mateusz Dudek, Łukasz Sadowski

PII: S0263-8223(19)32708-4
DOI: https://doi.org/10.1016/j.compstruct.2019.111668
Reference: COST 111668

To appear in: *Composite Structures*

Received Date: 17 July 2019
Revised Date: 1 November 2019
Accepted Date: 3 November 2019

Please cite this article as: Ostrowski, K., Dudek, M., Sadowski, L., Compressive behaviour of concrete-filled carbon fiber-reinforced polymer steel composite tube columns made of high performance concrete, *Composite Structures* (2019), doi: https://doi.org/10.1016/j.compstruct.2019.111668

Compressive behaviour of concrete-filled carbon fiber-reinforced polymer steel composite tube columns made of high performance concrete

Krzysztof Ostrowski[1, ✉], Mateusz Dudek[2] , Łukasz Sadowski[3]

[1] Institute of Building Materials and Structures, Cracow University of Technology, 24 Warszawska Str. 31-155 Cracow, Poland

[2] Strata Mechanics Research Institute, Polish Academy of Sciences, ul. Reymonta 27, 30-059, Cracow, Poland

[3] Faculty of Civil Engineering, Wroclaw University of Science Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wroclaw, Poland

✉: krzysztof.ostrowski.1@pk.edu.pl

Abstract:

The confinement of concrete-filled steel columns (CFT) with carbon fiber-reinforced polymer (CFRP) has been extensively studied in recent decades due to their significant applications for the strengthening purposes or construction of composite structures. A CFT column consists of a steel tube and inner-filled concrete, where the steel tube is used as a form and confinement of the concrete, with the concrete being the core that prevents buckling of the tube. Due to the development of concrete technology, high performance concrete (HPC) is increasingly used as the internal material of CFT. However, CFT columns are susceptible to local buckling and constant confining stress after yielding of the steel tube. This is why concrete-filled carbon fiber-reinforced polymer steel composite tubes (CFCT) have been considered. The key parameter, which determines load-carrying capacity, and axial and transverse deformation is the number of CFRP layers. The test results showed that local buckling of the steel tube can be effectively eliminated and that the compressive strength of CFCT is enhanced by the external confinement. It has been shown that the stress-strain characteristic depends on confinement pressure. This paper also discusses damage patterns and presents analysis of limit load capacity based on both laboratory experiments and numerical calculations.

Keywords: composite column, fibre-reinforced polymer material, high performance concrete, mechanical properties, numerical analysis, finite element method