

Punching shear resistance of UHPFRC

Andreas P. LAMPROPOULOS

Principal Lecturer

University of Brighton

Brighton, UK

a.lampropoulos@brighton.ac.uk

Dr Andreas Lampropoulos is a Principal Lecturer in Civil Engineering at the University of Brighton in the UK

James N. DUNCAN

BEng Civil Engineering student

University of Brighton

Brighton, UK

j.duncan3@uni.brighton.ac.uk

James Duncan is a final year BEng Civil Engineering student at the University of Brighton in the UK

Ourania T. TSILOULOU

Senior Lecturer

University of Brighton

Brighton, UK

o.tsioulou@brighton.ac.uk

Dr Ourania Tsioulou is a Senior Lecturer in Civil Engineering at the University of Brighton in the UK

Contact: a.lampropoulos@brighton.ac.uk

1 Abstract

Ultra-High Performance Fibre Reinforced Concrete (UHPFRC) is a high performance cementitious material with enhanced strength in tension and compression and significantly high energy absorption in the post crack region. Its mix composition is not much dissimilar from that of normal strength concrete. The main difference is that only fine aggregates are used in order to enhance the homogeneity of the mix, while microsilica is used to improve the density of the mix thereby reducing voids and defects. A high percentage of steel fibres is used to increase the tensile strength and at the same time to provide ductility.

UHPFRC has been recently introduced in applications such as bridge decks, thin slabs and for the strengthening of existing elements. Even if there are various published studies on the compressive, tensile and flexural characteristics of UHPFRC, the punching shear performance of UHPFRC without additional steel bars has not been sufficiently studied. In this paper an extensive experimental work has been conducted on UHPFRC tiles with various thicknesses and various percentages of steel fibres and tests have been conducted under a concentrated load. Using the experimental results, the punching shear characteristics of the various UHPFRC mixes have been evaluated and shear resistance values have been proposed.

Keywords: UHPFRC; slabs; punching shear.

2 Introduction

Ultra-High Performance Fibre Reinforced Concrete (UHPFRC) is a relatively new construction material which has been extensively used in the last few years in various applications including, bridge decks, thin structural elements and strengthening applications. Its special mix design provides superior mechanical characteristics and enhanced ductility, and this makes UHPFRC one of the most popular high strength cementitious material for structural applications. There is quite extensive research on the effectiveness of UHPFRC for the

structural upgrade and more specifically on the flexural and shear strengthening of existing Reinforced Concrete (RC) elements and it has been found that the addition of UHPFRC can significantly improve the structural performance of the existing elements [1-3]. The effectiveness of the addition of UHPFRC layers for the improvement of the punching shear resistance of RC slabs has also been examined and it has been found that significant improvement of the punching shear resistance of existing slabs can be achieved by the addition of UHPFRC [4] layers, while an analytical model for the prediction of the punching shear of

<https://doi.org/10.2749/newyork.2019.0866>

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