Flexural Behavior of a New Steel-UHPFRC Composite Beam with In-Built Steel Dowel as Connector

Xiujiang Shen

College of Civil Engineering, Hunan University, Changsha 410082, China

Sustainable Materials, VITO, Boeretang 200, 2400 Mol, Belgium

Yaobei He, Yu Li

Hunan Provincial Communications Planning, Survey & Design Institute CO., LTD, Hunan, Changsha 410082, China

Xudong Shao

College of Civil Engineering, Hunan University, Changsha 410082, China

Contact: xiujiangshen@hnu.edu.cn

Abstract

A lightweight steel-UHPFRC composite beam structure, consisting of a half rolled section with in-built steel dowels as connectors and a T-shaped UHPFRC component, is proposed originally in this paper. The excellent properties of steel and UHPFRC materials can be exploited fully and properly, and the presence of in-built steel dowel is expected to allow effective force transmission between steel and UHPFRC components, benefiting from its higher shear resistance and ductility. Two composite beams with various heights of UHPC web are tested by 4PBT method, aiming at validating this concept and investigating the flexural behavior under sagging moment. And a high resolution Digital Image Correlation (DIC) system is applied during testing, in addition to conventional measuring techniques. Moreover, the sectional analysis method considering the tensile properties of UHPFRC is applied to predict the flexural.

Keywords: composite beam; UHPFRC; rolled section; steel dowel; in-built connector; flexural behaviour; sectional analysis; DIC.

1 Introduction

Benefiting from the outstanding mechanical properties and durability of Ultra High Performance cementitious Fiber Reinforced Composites (UHPFRC) [1], the combination of UHPFRC and steel in composite structure allows more elegant and slender filigree element compared with conventional steel-concrete composite member in bridge engineering. The challenging tasks of the concept include: (1) proper geometry and arrangement of UHPFRC and steel components to fully utilize both materials; (2) efficient interaction between two components to ensure overall structural performance.

https://doi.org/10.2749/nanjing.2022.0710
Distributed by structurae