World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:11, No:04, 2017

Experimental and Analytical Study on the Bending Behavior of Concrete-GFRP Hybrid Beams

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Abstract : Recently, the use of GFRP pultruded profiles increased in the domain of civil engineering especially in the construction of sandwiched slabs and footbridges. However, under heavy loads, the risk of using these profiles increases due to their high deformability and instability as a result of their weak stiffness and orthotropic nature. A practical solution proposes the assembly of these profiles with concrete slabs to create a stiffer hybrid element to support higher loads. The connection of these two elements is established either by traditional means of steel studs (bolting in our case) or bonding technique. These two techniques have their advantages and disadvantages regarding the mechanical behavior and in-situ implementation. This paper presents experimental results of interface characterization and bending behavior of two hybrid beams, PB7 and PB8, designed and constructed using both connection techniques. The results obtained are exploited to design and build a hybrid footbridge BPBP1 which is tested within service limits (elastic domain). Analytical methods are also developed to analyze the behavior of these structures in the elastic range and the ultimate phase. Comparisons show acceptable differences mainly due to the sensitivity of the GFRP moduli as well as the non-linearity of concrete elements.

Keywords : analytical model, concrete, flexural behavior, GFRP pultruded profile, hybrid structure, interconnection slip, push-out

Conference Title : ICCEBM 2017 : International Conference on Civil Engineering and Building Materials
Conference Location : Boston, United States
Conference Dates : April 24-25, 2017