

Structural Performance of RC Beams Strengthened by SRG and FRCM System

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Summary

This paper presents the results obtained from an experimental investigation carried out on full-size reinforced concrete beams, which are strengthened in flexure and flexure/shear using different external reinforcement systems having an inorganic matrix, such as SRG (Steel Reinforced Grout) and PBO (Polyparaphenylene Benzobisoxazole) FRCM (Fiber Reinforced Cementitious Matrix).

In order to study the effect of the external composite reinforcement, variations in the number of applied layers and in the external end arrangements were made. All beams were extensively instrumented and tested under four point bending.

The performance of the strengthened beams, in terms of strength and ductility, was evaluated and compared with the control beam to highlight the main parameters that affect the mode of failure and the global behaviour of the structural elements.

Keywords: Steel Reinforced Grout, Fibre Reinforced Cementitious Matrix, Reinforced Concrete.

1. Introduction

It is now recognised that structural strengthening of reinforced concrete (RC) structures and infrastructures, by using externally applied composite systems, is an efficient and versatile technique, widely used in the civil construction industry.

Recently, innovative advanced composite systems, such as Fibre Reinforced Cementitious Matrix (FRCM), Steel Reinforced Polymer (SRP), and Steel Reinforced Grout (SRG) show to be a very effective and interesting solution for strengthening RC structures [1], [2], [3], and [4]. The systems are of easy installation, demonstrating their similarity to more traditional Fibre Reinforced Polymer (FRP) as well as allowing other advantages, such as fire resistance.

The FRCM reinforcement system consists of fibre nets as Polyparaphenylene Benzobisoxazole (PBO) mesh embedded into an inorganic stabilised cementitious matrix, designed to connect the mesh with the concrete substrate, whereas the SRP composites consist of steel wires forming cords that are assembled into a fabric and embedded within a polymeric matrix; and the SRG composites system are similar to the SRP except for the matrix that is replaced with a cementitious grout.

This paper presents the results obtained from an experimental investigation, carried out on a group of three RC beams, externally strengthened in flexure and flexure/shear by a SRG system and another group of similar beams strengthened by using a PBO FRCM system. The overall performance of the strengthened beams, in terms of strength and ductility, was evaluated and compared.

It is shown that both composites significantly enhance the strength of the concrete members highlighting their suitability for practical applications concerned with upgrading the existing structures and infrastructures.