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Study on behavior of RCC beams with externally bonded FRP members in flexure

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Abstract. The flexural behavior of Fiber reinforced polymer (FRP) sheets has gained much research interest in the flexural strengthening of reinforced concrete beams. The study on flexure includes various parameters like increase in strength of the member due to the externally bonded (EB) Fiber reinforced polymer, crack patterns, debonding of the fiber from the structure, scaling, convenience of using the fibers, cost effectiveness, etc. The present work aims to study experimentally about the reasons behind the failure due to flexure of an externally bonded FRP concrete beam. In the design of FRP-reinforced concrete structures, deflection control is as critical as much as flexural strength. A numerical model is created using Finite element (FEM) software and the results are compared with that of the experiment.

Keywords: GFRP; CFRP; flexural study; external bonding; numerical analysis

1. Introduction

Fibre reinforced composites have been widely used to strengthen reinforced concrete (RC) members. Mostly because they have a high strength-to-weight ratio, require relatively limited time to cure, and have mechanical properties that can be engineered to meet the desired structural performance. A fibre-reinforced polymer (FRP) composite is made up of continuous fibres and a thermosetting organic resin. It is currently the most common type of composite system used for structural strengthening applications. Fibre reinforced cementitious matrices (FRCM) composite was another type of composite that was recently developed which contains continuous fibres with a cementitious (inorganic) matrices. The substantial increase in energy absorption capacity is the most significant improvement imparted by adding fibres to a concrete. The FRP laminates were produced by the process called pultrusion. Pultrusion technology of manufacturing of fiber composites with polymer matrices appears to be energy-efficient and resource-saving. Pultruded FRP sections are usually made by pultrusion process. This process creates continuous composite profile by pulling raw composites through a heated die. Pultrusion combines words “pull” and “extrusion” where extrusion is pulling of material such as fiberglass and resin, through a shaping die. The reinforcement materials like fibers or woven or braided strands are impregnated with resin, possibly followed by a separate performing system, and pulled through a heated stationary

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Kolluru, V.S., Christian, C. and Lucio, N. (2007), "Width effect in the interface fracture during shear bonding of FRP sheets from concrete", *Eng. Fract. Mech*., **74**, 578-594.
Lesley, H.S., Salvatore, V., Christian, C. and Luciano, O. (2016), "Flexural behavior of RC beams strengthened with steel-FRCM composite", *Eng. Struct*., **127**, 686-699.
Prota, A., Tan, K.Y., Nanni, A., Pecce, M. and Manfredi, G. (2006), "Performance of shallow reinforced concrete beams with externally bonded steel-reinforced polymer", *ACI Struct. J*., 163-170.
Thomsen , H., Spacone, E., Limkatanyu, S. and Camata, G. (2004), "Failure mode analyses of reinforced concrete beams strengthened in flexure with externally bonded fiber-reinforced polymers", *J. Compos. Constr*., **8**, 123-132.
Xiong, G., Yang, J. and Ji, Z. (2004), "Behavior of reinforced concrete beams strengthened with externally bonded hybrid carbon fiber-glass fiber sheets", *J. Compos. Constr*., **8**, 275-278.

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