Optimization of Flyash and Metakaolin Content in Mineral Based CFRP Retrofit for Improved Sustainability

Raghavendra Vasudeva Upadhyaya*, Thuraichamy Guganesan Suntharavadivel

School of Engineering and Technology, Central Queensland University, Rockhampton, QLD, Australia

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Abstract

The significance of rehabilitating deteriorated concrete structures subjected to inflated traffic volume, unprecedented live loads, structural ageing and other environmental impacts has been garnering attention in the recent years. Amidst a few conventional retrofit techniques, the application of externally bonded Fibre Reinforced Polymers (FRP) remains contemporary. It is a noteworthy reformation technique because of its durability, augmented mechanical performance and long-term cost-effectiveness. Epoxy resin is classified as a hazardous polymer (as per Globally Harmonised System of Classification and Labelling of Chemicals – GHS) and it has been the most sought bonding fix for several FRP retrofit approaches. Scientific and literature evidence demonstrate the health and environmental impacts concerned with the use of this noxious resin. The primary objective of this project is to optimize the mix proportion of a recently developed Mineral Based Composite (MBC) bonder by inducing varying amounts of industrial by-products such as fly ash and metakaolin. It was observed that a certain degree of this replacement resulted in achieving a higher degree of sustainability as the event-grade bonder could potentially eliminate the use of epoxy in FRP reformation. Experimental investigation as per Australian Standards AS 1012.1:2014 established the relation between brittle epoxy failure and thus rendering the up surged bonding capacity of MBC in extreme conditions proving as the desired substitute for epoxy resin. The investigative results obtained portray a suitable base for evaluating the optimal mix design proportion of the mineral composite bonder.

Keywords: rehabilitation, sustainability, MBC, epoxy, temperature, FRP retrofit, flyash, metakaolin

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* Corresponding author. E-mail address: r.vasudevaupadhyaya@cqu.edu.au

Tel.: +617-49309881

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