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Mechanical performance of FRP-confined and unconfined crumb rubber concrete containing high rubber content

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ABSTRACT: The use of crumb rubber in concrete has been practiced for some years. It is an effective environmental approach to use to reduce the amount of scrap tyres in landfills around the world. However, there are concerns about the mechanical properties of crumb rubber concrete (CRC) and its associated applications. The main purpose of this study is to provide a closer look at different mechanical properties of fibre reinforced polymer (FRP) confined and unconfined CRC with high rubber content. In this study, six concrete mixtures having 0, 10, 20, 30, 40, and 50% rubber content replacement of sand volume were produced. Different mechanical properties including compressive strength, tensile strength, modulus of elasticity, unit weight, impact resistance, water absorption, temperature effect, stress-strain behaviour, and FRP-confinement effect were measured. The results indicated that the use of FRP to confine rubberized concrete effectively negates the decrease in strength, and retains the advantages of increased ductility that arise from rubberized concrete. In addition, increasing concrete rubber content from zero to 50% increased its impact resistance by approximately 3.5 times. This indicates promising potential for structural applications, particularly in seismic zones.

Keywords: Crumb rubber concrete, Impact resistance, Water absorption, FRP-confined concrete, Confinement technique.

1 INTRODUCTION

Management of scrap tyres has created an environmental crisis because of the large volume of waste generated by the vehicle use. Millions of worn out vehicle tyres are dumped to landfill annually, providing a breeding ground for pest and mosquitoes due to the non-biodegradability of the rubber [1]. One of the most popular methods of tyre disposal is to stockpile them in landfills but due to their low density, and consequently large volume well as poor degradation properties they cannot be buried in landfills [2]. Tyres can trap methane gases, causing them to become

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