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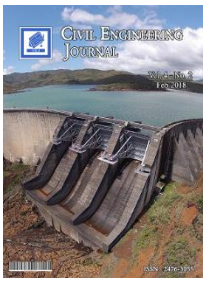

Flexural Behaviour of Lightweight Foamed Concrete Beams Reinforced with GFRP Bars

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Abstract

Lightweight foamed concrete is a type of concrete characterized by light in self-weight, self-compaction, self-leveling, thermal isolation, and a high ratio of weight to strength. The advantages of GFRP bars include lightweight, high longitudinal tensile strength, non-conductivity, and resistance to corrosion. This study investigated the behavior of LWFC beams reinforced with GFRP bars under flexural loading. A total of four reinforced concrete beams were cast, where it consisted of two LWFC beams and two normal weight concrete beam which acted as control specimen. One of the lightweight foamed concrete beams and the normal concrete beams is reinforced with two GFRP bars and the other reinforced with two steel bars. All beams were designed with singly reinforced of two bars of diameter 12 mm. The LWFC beams were with cement to sand ratio (1:1) and average dried density of 1800± kg/m^3. The main variables considered in this study was type of concrete and type of reinforcement. The flexural parameters investigated are ultimate load, crack width, ductility, deflection and stiffness. The lightweight foamed concrete beam reinforced with GFRP bars showed deflection and crack width greater than in beam reinforced with steel bars due to the low modulus of elasticity of GFRP bars.

Keywords: Foamed Concrete; GFRP Bars; Flexural Behavior; Light Weight.

1. Introduction

Lightweight foamed concrete is a building material characterized by satisfactory properties such as lightweight, thermal and sound isolation. The first attempt to produce foamed concrete was back to 1923, when J. A. Eriksson got a patent in the foamed concrete. The future need for construction materials which are light, durable, economic and more environmentally sustainable has been specified by many researchers around the world [1-3]. Significant improvements in the production process and the quality of foaming agents over the last fifteen 15 years have led to increased production and expansion the range of its applications [4-7].

The properties and structural behavior of lightweight foamed concrete such as compressive strength, shear and flexural behavior has been studied by several researchers[8, 9, 10].In (2011) Tan, et al. studied the flexural behavior of two reinforced lightweight foamed concrete beams with hardened density (1750 ± 50 Kg/m^3). They found that the ultimate load of reinforced lightweight foamed concrete beams lower than normal concrete beam by (22%) to (24%) [9].

In (2005) Jones and McCarthy studied the scale of two reinforced coarse fly ash foamed concrete beams (200 mm x 300 mm x 2000 mm) with densities (1400 and 1600 Kg/m^3) under flexural loading compared it with a 25 MPa normal weight concrete beam. They found that the deflections at the failure of foamed concrete were up to 2.3 times greater than that of the normal concrete beam [11]. In 2017, Lee et al. presents the experimental results on flexural behavior of

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