



Experimental Analysis on Tensile Behavior of Engineered Cementitious Composite (ECC) using Polypropylene Fiber

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Abstract

The high demand of tensile strength in concrete is always a critical issue for engineers, as 10% of the compressive strength is not sufficient to withstand higher loadings. Lesser ductility and strain capacity is another major issue of normal concrete. In the queue of modern researches, this paper is an attempt to study Engineered Cementitious Composite (ECC) from research of Professor Victor Li, the University of Michigan. ECC is an ultra-ductile cementitious composite which is highly crack resistant, with a high tensile strain capacity over that of normal concrete. The composite replaces coarse aggregates and fine aggregates by sand and fly ash respectively. ECC is made up of OPC, sand (passing from 250 μ m and retained on 150 μ m), Fly Ash (Class F) with addition of Polypropylene fiber on different percentages i.e. 0%, 0.25%, 0.5%, 0.75%, 1.0% were studied. Tensile Strength of ECC was measured by casting & testing cylinders of 4" x 8" in Universal Testing Machine (UTM). The experimental results revealed that 111.40% increment in tensile strength was found at 0.5% PP fiber at ECC 1:1:1 and an increment of 74.74% was observed at ECC 1:0.8:1.2 at 1% PP fiber. The study concludes that this composite could substitute the normal concrete where high tension is the ultimate requirement with higher strain capacity.

Keywords: ECC; Tensile Strength; Polypropylene Fiber; Concrete.

1. Introduction

Amongst all construction materials, concrete is most versatile material man have ever made. Due to its versatile characteristics, it is most widely used construction material of world. According to one study, its consumption is around 11.4 billion tons annually worldwide [1]. The tensile strength of normal concrete is within the range of 10 % of the compressive strength of the concrete. This figure is never sufficient for the cases where the tensile strength is higher priority. The low tensile strength of the material kept the material engineers indulges in experiments and resulting in modern researchers on concrete. This tensile behavior of concrete is amongst a priority in the development of fiber concrete and other invention and researches in the field of concrete technology. Keeping in view the various drawbacks of normal concrete (i.e. cement matrix micro-cracks resulting from shrinkage or excessive loading, destruction of the material in a brittle manner etc.), numbers of researchers in past were carried to make this material ideal for construction. In the same queue, a modern type of composite has developed by Prof. Victor Li known as Engineered Cementitious Composite (ECC). According to him, Engineered Cementitious Composite (ECC) is an easily molded mortar-based composite reinforced with polymer fibers [2]. In the upcoming developments of safer, lighter, long lasting concrete

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