

Effects of Fiber Volume Fraction and Aspect Ratio on Mechanical Properties of Hybrid Steel Fiber Reinforced Concrete

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Abstract

In recent years, a new type of fiber reinforced concrete (FRC), called hybrid FRC, comprised of fibers of the same material but with different geometry has been developed. The aim of this paper is to investigate the influence of volume fraction and aspect ratio of steel fibers on the basic engineering properties of hybrid steel fiber-reinforced concrete. To this end, steel fiber reinforced concrete composites, comprised of different combinations of fiber volume fraction and fiber size/shape, are experimentally tested and compared in terms of compressive, splitting tensile strengths and flexural toughness by four-point bending tests. The results indicate that both micro and macro size steel fibers generally improve various engineering properties of concrete, despite advantages of one on the other for different mechanical properties. Straightforward relations are proposed relating the significant mechanical properties of hybrid steel FRC to the volume fraction of micro and macro steel fibers in the composite.

Key words: Hybrid Fiber Reinforced Concrete; Micro Steel Fiber; Macro Steel Fiber; Four-Point Bending Test; Compressive Strength; Splitting Tensile Strength

1. Introduction

In the construction industry, concrete is probably the most vastly used material worldwide, mainly due to its relatively low cost and the ability to alter its properties for a wide range of different applications. The properties of a concrete mix can be enhanced by adding various additives or