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Efficiency of Steel Fiber on Carrying Capacity of Short Square Columns

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Abstract

An experimental investigation is carried out to find the beneficial effect of adding steel fiber to reinforced concrete square columns. Hooked end steel fiber type is used in this investigation. The aspect ratio is 60 and the percentages of the steel fiber that added to the concrete are 0.5%, 1.0% and 1.5%. The experimental work consists of fabricated twenty columns to observe the effect of steel fibers on the axial and bending moment capacity. The specimens are classified into five groups according to the applied load on it. Each of these groups is consisted of four columns having different steel fiber ratios (0, 0.5, 1.0 and 1.5) %. The columns are tested under concentric, eccentric with variable eccentricities and two-point loading. All tested columns in a one group having the same dimensions, same interior reinforcement and were tested under one applying–load and they have a square cross-section with a dimension of (100 × 100) mm. Specimens with steel fiber results are compared with the control specimen of their own (columns mad of plain concrete). The results showed that increasing steel fiber ratio is caused an increasing in the first cracking load and an increase in the ultimate load for all tested columns.

Keywords: Steel Fiber; Column; Axial Capacity; Moment Capacity.

1. Introduction

The building material that widely used in the world is concrete, and its brittle properties are considered the most important disadvantage. The failure of a structure happens because of the brittleness of concrete bring about destructive property damage and loss of life. This disadvantage may be overcome by the addition of steel fibers to the concrete that will convert concrete to a ductile material.

Mix steel fiber with cement, fine aggregate and coarse aggregate will obtained the steel fiber reinforced concrete (SFRC). The addition of steel fiber to the concrete improves it in the flexural strength, shear, impact strength, torsional strength, fatigue strength, tensile strength, and failure toughness and shock resistance in addition ductility. Steel fiber used in the concrete resists the spread of cracks because of the bonding force between the concrete and the steel fiber.

It is particularly valuable in reducing cracks because of concrete shrinking in a hot climate. Furthermore, the excellent ductility of SFRC renders this material worthy for military purposes such as building an underground security structure against shelling.

In this work, the effects of adding different hooked end steel fiber ratios to reinforced concrete square columns have been investigated, through experimental tests done on twenty specimens.

The effectiveness of the addition of steel fibers in concrete columns subjected to an axial load has been studied by many researchers. Adding steel fibers within the concrete leads to reduction in workability and increase in concrete strength and ductility [1]. The addition of steel fiber to the concrete columns leads to an increase in the carrying capacity and converts the cover spalling from a sudden technique to a gradual technique [2]. When adding 0.5% steel fiber the

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