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Experimental Investigation of Fiber Reinforced Concrete Beams

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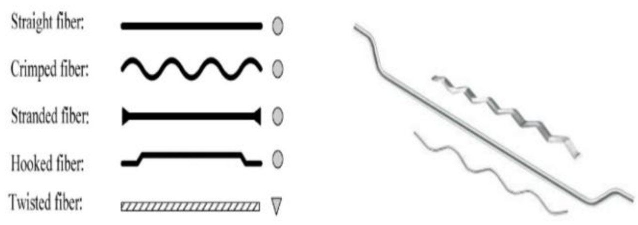
Abstract - *The Shear strength of fiber reinforced concrete beams has been studied in this research project. Three types of fibers have been examined: hooked-end steel fiber, crimped-steel fiber, and crimped-monofilament polypropylene fibers.The experimental program Included five ray samples. Two of the beams were control samples in which one was reinforced with a minimum shear reinforcement according to ICI, while the other had no shear reinforcements. Each of the other three samples was reinforced with one of the fibers mentioned above in a volume ratio of 1%. In addition to bundle samples, three prisms for each type of fiber were also made to determine their toughness. The objective of this survey was to investigate the following questions for the resistance Of medium-high concrete 1) to assess the effectiveness of each type of fiber in shear strength, 2) to investigate shear strength, tenacity, and nearly definitive patterns of cracks and crack width of each bundle, and 3) to determine whether the use of a 1% volume ratio of the fibers as shear reinforcement in the beams will provide adequate strength and stiffness properties comparable to the reinforcement used as minimum shear reinforcement. The outcomes demonstrated that the three sorts of filaments expanded the cutting limit of the bar tests more than the fortified bar with a base cutting support. Moreover, a portion of the filaments utilized could change the sort of disappointment from an unadulterated shear break to a consolidated shear twist or an unadulterated bowing disappointment.*

1. INTRODUCTION

Historically, many efforts have been devoted to improving the behavior of concrete structures. Flexibility, compression, shear resistance, ductility and other properties have been the focus of many researchers who have tested concrete with steel and other materials to improve concrete behavior. The concept of adding fibers to improve the behavior of fragile materials is old. For example, the Mesopotamians used straw to reinforce sun-burned bricks. This ancient technology is still used to improve concrete characteristics. Nowadays, the fibers are produced from different materials such as steel, glass, carbon and synthetic material. Each of these fibers has its specific benefits. However, steel fiber is the most common. It was reported [1] that the first experimental test to improve the characteristics of concrete using discontinuous steel reinforcement elements, such as nail segments, was performed in 1910. However, it was not until 1963 [1] when the main experiments to improve the concrete. Features that use real steel fibers. A typical length of steel fibers varies from 0.25 to 2.5 inches (6 to 64 mm) and their diameter ranges from 0.02 to 0.04 inches (0.5 to 1.0 mm). Steel fibers are produced in different ways, as shown in Figure 1-1. This type of fiber is commercially available with a tensile strength of up to 300 ksi (2068 MPa).



(a)

(b)

Fig. 1- Type of fibers; (a) Steel fibers; (b) polypropylen e fibers reinforced concrete

1.1 Objective and Scope of the Research

The target of this examination was to research the accompanying parts of bond of fiber limit of medium-high solid pillars. 1) to assess the viability of each kind of fiber (steel closes, snare closes, crease steel strands and polypropylene filaments) in the shear quality of the pillars, 2) to research shear quality, industriousness, break examples and split practically last width of each group, and 3) to decide if the utilization of a volumetric proportion of 1% of the fortifying strands as shear shafts give quality and firmness properties to coordinate equivalent strengthening steel utilized as least shear fortification. The test program included five beam tests. Two pillars were control tests, one was strengthened with insignificant shear support utilizing ICI fortifying steel, while the otherhad no shear fortifications.

1.2 Mechanical Properties of SFRC

As referenced over, the utilization of filaments to improve the qualities of delicate materials is extremely old. In the mid 1960s [1], steel fiber was presented as another fiber variant. Straight fiber was the main sort of fiber. The association of this fiber relied upon the grating between bond and fiber. Subsequently, a rectangular segment with higher extents was more proficient. The job of steel fiber is to possess the proliferation of small scale breaks. There are two conceivable fiber disappointment situations. The first is the fiber break and the second is the extraction of the solid filaments. The subsequent situation is progressively ideal since it is increasingly malleable and goes about as a vitality safeguard. At the end of the day, because of the fiber to be removed, the snared end fiber and the wavy fiber must twist and deliver fundamentally. Accordingly, this procedure will ingest a lot of vitality. One of the elements that impact the sort of flaw is the relationship between steel fiber and cement. A connection [2] has been inferred to decide the basic length of the fiber, after which the fiber experiences a break rather than an extraction, when a cut cuts the fiber at the midpoint.

2. Experimental Program

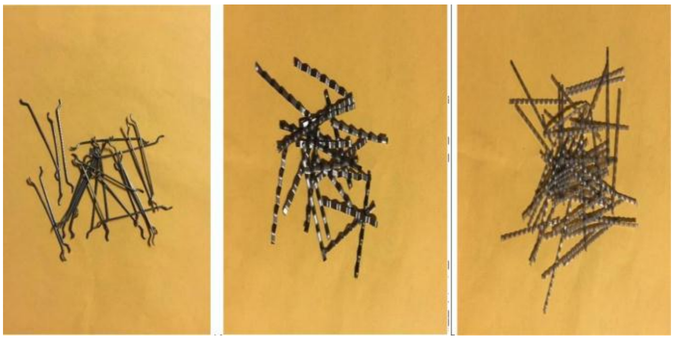
As mentioned above the fibers are used to improve the characteristics of plastic and hardened concrete. The experimental program of this research provides a better understanding of the use of steel fiber, hybrid hybrid and fibrillated polypropylene fiber and hybrid monofilament and fibrillated polypropylene fiber to improve the characteristics of the concrete. The objective of the experimental program was to answer the following questions:

• What is the shear strength, cracking patterns, crack width and flexural strength of fiber-reinforced concrete?

• How do these results change if the type of fiber is changed?

• 1% fiber can be used to replace the minimum cutting reinforcement as specified by ICI.

The strength of concrete for experimental beams was selected as a "medium-high" capacity of 6000 psi. This ability has been selected to reflect the expected capacities of the future cement, probably in the next or twenty years. The experimental program involved the design, manufacture and testing of approximately one third of the scale that simply supported samples subjected to two concentrated symmetrical loads. In addition, a fiber bonding test, a mixing test, a cube test and a reinforcement test were performed. The experimental program consisted of five radius samples of the same size. Each sample had a different cut resistance system. The first three samples were reinforced with a volumetric ratio of 1% of polypropylene in hardened steel, crimped steel and seamed monofilament. The fourth specimen was reinforced with a minimum cut steel reinforcement specified by ICI. The last one had no steel or fiber reinforcement.



Hooked end steel Crimped steel Crimped PPI

Fig. 2 -; Type of various fibers

Fig . 3 -: Steel fabrication and form work

Fiber type	Diameter	Length	Aspect ratio
Novocon 1050	0.039 in (1.0 mm)	2 in (50 mm)	50
Novomesh 850 (*)	-	1.5 in (38 mm)	34
Novomesh 950(*)	0.033 in (0.83 mm)	1.8 in (45 mm)	55

3. CONCLUSIONS

1. The use of 1% of the seamed polypropylene fiber has increased the resistance to cracks by bridging the micro cracks. However, this effect is diminished in the case of the printed steel fiber disappeared due to the steel fiber hooked to the end.

2. The use of a volumetric ratio of 1% of the steel fiber at the end of the hook has greatly improved the characteristics after breaking or flexural strength. This effect decreased slightly when corrugated steel fiber was used. However, in the case of seamed polypropylene fiber, the flexural strength has been considerably reduced.

3. For bundle samples, the three types of fibers have increased the number of cracks, especially in the case of steel fibers. The steel fiber reinforced beams have developed more slots than the control beams, which indicates a better redistribution of the voltage. Furthermore, the steel fiber of the hook-shaped end has changed the diagonal voltage break mode, which was observed in the control samples and in the reinforced beam failure. The failure mode

in the case of seamed steel fiber was a combination of compression failures and shear failures.

4. The results showed that the three types of fibers could increase the flexural strength of the beams more than that reinforced with the traditional reinforcement based on the minimum reinforcement specified in the ICI. The three types of fiber showed an increase in shear strength up to 5.0.

5. Both types of steel fibers have improved the ductility of the beam beyond the ductility of the beam with minimal cutting reinforcement. Therefore, it is observed that a volumetric ratio of 1% of steel fiber is able to replace the traditional minimum of cutting reinforcement.

6. Self healing capacity is also observed in FRC beams while conducting Experiment, self healing by Calcium carbonate crystals leads to reducing water permeability and recovery of tensile strength.

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