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COMPARISON OF ANALYSIS AND DESIGN BETWEEN A COMPOSITE STRUCTURE AND A REINFORCED CONCRETE

D.Raghupathi (Asst. Prof) [1]. Tella Meghana. M Tech[2]
Siddhartha Institute of Technology & Sciences (SITS) Narapally village, Peerzadiguda, Hyderabad, Telangana 500088

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ABSTRACT
Worldwide, a great deal of research is currently being conducted concerning the use of fiber reinforced plastic wraps, laminates and sheets in the repair and strengthening of reinforced concrete members. Fiber-reinforced polymer (FRP) application n is a very effective way to repair and strengthen structures that have become structurally weak over their life span. FRP repair systems provide an economically viable alternative to traditional repair systems and materials. Experimental investigations on the flexural and shear behavior of RC beams strengthened using continuous polypropylene fiber reinforced polymer (PFRP) sheets are carried out. In this project the experimental investigation conducted on the use of polypropylene fibre of length 12mm and 24mm, having an aspect ratio of around 800 was employed in equal percentages of
0.5 percentages by weight in cast concrete and tests like compressive strength, flexural strength and split tensile strength. Conventional concrete have very low tensile strength and small resistance to cracking. Internal cracks were inherently present in concrete and its poor tensile strength is due to the propagation of such micro cracks. Fibers added to a certain percentage of the concrete improve the strain value as well as crack resistance and flexure strength.

Keywords: *polypropylene fiber reinforced polymer (PFRP), Conventional concrete, flexural strength and split tensile strength*

INTRODUCTION

Historical Background and Development of Fibers

Historically, much effort has been spent improving the behavior of concrete structures. Flexural, compressive, shear strength, ductility, and other properties have been the focus of many researchers who have tested concretes with added steel and other materials to improve the behavior of concrete. The concept of adding fibers to improve brittle material behavior is ancient. For example, Mesopotamians used straw to reinforce sunbaked bricks. This ancient technology is still used to improve concrete characteristics. Nowadays, fibers are produced from different materials such as steel, glass, carbon, and synthetic material. Each one of these fibers has it specific benefits. However, steel fiber is the most common one. It has been reported [1] that the first experimental trial to improve concrete characteristics using discontinues steel reinforcing elements, such as nails segments, was done in 1910. However r, it was not until 1963 [1] when major experiments were done to improve concrete characteristics using a real steel fibers. A typical length of steel fibers ranges from 0.25 to 2.5

in (6 to 64 mm), and its diameter ranges from 0.02 to 0.04 in (0.5 to 1.0 mm). Steel fibers are produced in different forms as shown in figure1- 1. This type of fiber is available commercially in tensile strength up to 300 ksi (2068 MPa).

In order to overcome problems with steel fibers such rusting, researchers have studied other types of fibers. Synthetic fibers (polypropylene and nylon) are some of these fibers. Polypropylene fibers were used for the first time in 1965 in the construction of blast resisting building for the United States Army Corps of Engineers (USACE). Earlier studies [1] showed that these fibers were not successful like steel and glass. However, a better understanding of fiber behavior, new types of fibers, and other factors led to successful synthetic fiber.

Behavior of Fiber in Concrete

Fibers contribute towards reducing the bleeding in fresh concrete and renders concrete more impermeable in the hardened stage. Contribution of certain percentage of fibers in concrete towards flexural strength is smaller compared to the strength given by the rebars. Most importantly fiber restricts the growth of crack under load thereby arresting ultimate cracking. Nonmetallic fibers like alkali resistant glass fiber and synthetic fibers provide resistance against chemicals. Reinforcing capacity of fiber is based on length of fiber, diameter of fiber, the percentage of fiber and condition of mixing, orientation of fibers and aspect ratio. Aspect ratio is ratio of length of fiber to its diameter which plays an important role in the process of reinforcement.

OBJECTIVES

The main objective of this investigation was

- To Study the flexural behavior of polypropylene fiber reinforced concrete.
- To compare Compressive strength of the Cube and the Split tensile strength of the Cylinder.
- To investigate the load-deformation of polypropylene fiber characteristic and load carrying capacity

LITERATURE REVIEW

B. Vijaya and Dr.S.Elavenil et al.(2015) state that The mix with manufacturing sand as 100% fine aggregate gives initial workability of 170mm, which is much higher than that of the mixes with 100% river sand(RS) and crusher dust. The standard mix with 100% manufactured sand has exhibited much higher compressive strength 53 MPa. The standard mix with 100% of river sand has exhibited compressive strength of 49MPa, 7.5% lower than that of manufactured sand.

Research findings concluded that, compared to concrete made from river sand, high fines concrete generally had higher flexural strength, improved abrasion resistance, and higher unit weight & lower permeability due to fillings the pores with micro fines.

METHODOLOGY

Properties of polypropylene Fiber

- Length of fiber – 12mm and 24mm
- Elongation – 1.1
- Tensile strength - 1500 MPa
- Specific gravity – 0.91
- Resistance to alkali - Excellent
- Water absorption - 3 %
- UV resistance – High

Figure 1: polypropylene Fiber

RESULTS AND DISCUSSION

Compressive strength of Cube Polypropylene Fiber Reinforcement concrete

The compression test was conducted on cube specimens cured for 28 days. The test cubes were removed from the moist storage 24 hours before testing. The top and bottom bearing plates of the compression testing machine were wiped and cleaned before the placement of the specimen. Cube moulds of size 150 x 150 x 150 mm were casted and allowed for curing in a curing tank for 28 days. These cubes were tested on compression testing machine as per I.S.516-1959. The compressive strength was calculated as follows: Compressive strength (MPa) = Failure load / cross sectional area

Figure : Compression Test Equipment able

2: Compression Test Graph of control mix and % polypropylene fiber added mix

% of Polypropylene Fiber	**Compressive Strength (N/mm2) After 7 Days**	**Compressive Strength (N/mm2) After 28 Days**
0 %	14.56	31.23
0.5 %	15.34	31.86
1.0 %	17.34	33.62
1.5 %	16.86	33.12
2.0 %	16.13	32.31
2.5 %	15.13	31.93
3.0 %	15.97	31.54

ACONCLUSION

1. Fiber reinforced concrete gives more strength compared to normal concrete. The following quantity of fiber 0.5% to 1 % was added in concrete and their strength was compared with normal mix concrete and hence found that the concrete with polypropylene added is stronger than normal mix.
2. Thus, with the addition of fibers the compressive strength was increased even if, it was insignificant.
3. The addition of fibers improved the flexural strength of concrete significantly. The fiber reinforced concrete has the ability to hold on the crack of the concrete and resist the concrete beams from falling apart.
4. As the concrete is a fundamental material in the field of construction engineering, the improvement of its mechanical properties by the addition of this fiber will certainly increase the use of this composite material which will offer more strong and durable structures in the future and will open a new era in the field of construction materials.
5. So on an average to gain maximum compressive and tensile strength with mono- filament macro fiber the optimum dosage be limited 1%to 1.5%, after further increase these strength properties decreases.
6. So we can say that the increased compressive strength due to fiber percentage is due to fiber and aggregate bonding and not due to cement paste bonding. The fibers are acting as anchors between the cement paste and the fine and coarse aggregates which results in increased durability of concrete before failure.

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