AN EXPERIMENTAL INVESTIGATION ON INCORPORATION OF POLYPROPYLENE FIBERS IN CEMENT CONCRETE

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Abstract:- Humans always research on their surroundings to improve the quality of the existing things during this process they keep learning .Civil Engineers are no different as they always focus on improving the existing techniques to make things economical , durable as well as environmentally friendly .In this polypropylene fibers was incorporated with concrete pavements .This experimental investigation will not only enhance the durability and make it cost effective but also create an environment friendly option .With this addition of fibers we can replace the cement content and if we reduce the cement content , indirectly we will save our environment from Global warming , as we know during the production of cement larger amount of co2 is released into environment . We can make floors of this concrete, where the floors are likely to be attacked by acids and lab works. The aim of this experiment is to determine the advantages of fiber reinforced concrete to replace the traditional concrete pavement. This research proposed to analyze the different effects of using fibers on compression, flexural and split tensile strength of concrete. The objective of this work is to improve the quality of concrete. The fiber which was used in this work was polypropylene fiber of Aspect Ratio of 50, The length of the specimen was 45mm and diameter of 0.9mm. The fibers were incorporated with varying percentages of 0%, 0.2 %, 0.4 %, 0.6 %, 0.8 %, 1 % and 1.2 % by weight of concrete.

Keywords: - Fiber reinforced concrete, Polypropylene Fiber, aspect ratio, Compressive Strength

1. INTRODUCTION

The conventional concrete with the poor performance and when subjected to environmental conditions does not full fill the requirements .The use of composite material makes the concrete durable and strong .In this modern era ,Construction is not possible without the concrete and therefore is widely used and used in large quantity .It is widely used in every construction work varying from a small to the sky scrapers , from the culvert to the large span bridge from the small reservoir to the large dam etc full fills the main requirements .The usage of composite material makes the constructional material strong and enhances its quality .The plain concrete has many decencies as compared to the FRC .The FRC allows the concrete with strength and allow strain at fracture

These limitations of concrete can be rectified by the incorporation of fibers into the concrete . Current research stresses on the concept of durability , ductility and other properties .Fibers when induced to the concrete ,it generally utilized the concrete to manage the plastic shrinkage and drying , when the fibers are mixed with concrete not only the fraction of cement content is removed but also helps to modify the property of concrete like modify the permeability and therefore reduce the flow of water .Some fibber create greater impact towards the abrasion .The quality of fibers required for the concrete mix is normally determined as a percentage of the total volume of the composite material . when the fibers are added to the concrete it is called the fiber reinforced concrete as abbreviated FRC, which increases concrete toughness. The FRC does not fall immediately after the cracking starts, it gives us warning before it falls . After the first crack the load is transferred from the concrete matrix to the fiber, hence the role of Fibers is essential to arrest advancing of cracks

Polypropylene fiber concrete is the advanced type of concrete which is quietly different from the ordinary Portland concrete in many aspects. The fibers are added to the concrete at varying percentages upto the optimum dosage and the corresponding strengths are to be calculated. The polypropylene fiber concrete exhibits the property due to which the fibers interlock with each other thus results in the Stress- Strain properties that leads to increase in compressive strength, Tensile strength etc. This type of concrete can be used in the earthquake resistant buildings and is to be proved the best composite materials. The present investigation has been taken to by adding the polypropylene fibers to the concrete and to investigate the behavior of fiber under varying loading applied on it. The series of tests were conducted on it like split tensile strength , compressive strength and compressive strength test at various percentages and average strength were taken in account . Proper precautions were taken while these tests were performed. The calculated results were taken and then compared to those results which were obtained by the Researchers, In the present Research work, The polypropylene fibers were added at 0.2 %,0.4%,0.6% , 0.8% ,1% &1.2%by the weight of concrete for the grade of concrete M30.

2. LITERATURE REVIEW

N. Sohaib et al (2018) The aim of the study was to achieve maximum strength of concrete by using optimum weight of polypropylene fibers. 40 cylinders of polypropylene concrete were casted and tested for 7 and 28 days' strength for both compressive and split tensile strength. It was concluded that the significant improvement was observed in ultimate

compressive strength after 7 and 28 days. The optimum percentage of Polypropylene fiber was obtained to be 1.5 percent of cement by volume. The addition of small amount of polypropylene improved the mechanical properties of concrete.

Archana P et al (2017) Concrete (PFRC) has been introduced and evaluating the performance of polypropylene fiber reinforced concrete. In this they attempt to increase concrete ductility and energy absorption , polypropylene fiber reinforced. An experimental investigation explored properties such as compressive strength, flexural strength, split tensile strength and shear strength and shear strength of polypropylene fiber reinforced concrete. The fiber volume fraction v ranges from 0%,0.2%,0.4%,0.6%,0.8%,1%, to 2%. Significant change is found for compressive strength, flexural, split tensile and shear improves greatly, when compare to the plain concrete.

Abhishek (2017) The study involved a thorough review of the properties and testing of synthetic polypropylene fiber reinforced concrete (FRC). A standard test method for obtaining average residual strength of FRC was used to evaluate the performance of various concrete mixtures reinforced with synthetic polypropylene macro fibers. It was found out that the concrete with higher fiber proportions showed significantly higher residual load carrying capacity (post- cracking response). Moreover, the concrete mixtures had acceptable workability and showed only slight loss in compressive strength due to inclusion of fibers. The study investigated the rheological and mechanical properties of SCC reinforced with different proportions of fibers. It was shown that inclusion of fibers in SCC is feasible for the purpose of manufacturing structural elements like railway crossties.

Divya S Dharan and Aswathy Lal (2016) In this project work polypropylene fibers (Blended type) of different percentage (0.5%, 1%, 1.5%, and 2%) added in concrete. Tests on workability, compressive strength, flexural resistance, split tensile strength and modulus of elasticity were conducted on specimens. The polypropylene fibers of blended (24mm, 40mm, 55mm) type are used. The project deals with the effects of addition of various proportions of polypropylene fiber on the properties of concrete in fresh and hardened state and its effects on workability, compressive, flexural, split tensile strength and modulus of elasticity of concrete.

Kolli.Ramujee (2013) The interest in the use of fibers for the reinforcement of composites has increased during the last several years. A combination of high strength, stiffness and thermal resistance favorably characterizes the fibers. In this study, the results of the Strength properties of Polypropylene fiber reinforced concrete have been presented. The compressive strength, splitting tensile strength of concrete samples made with different fibers amounts varies from 0%, 0.5%,1% 1.5% and 2.0% were studied. The samples with added Polypropylene fibers of 1.5 % showed better results in comparison with the others.

Gupta (2001) studied the effect of addition of crimped round steel fibres on the splitting tensile strength of concrete. They proposed equations based on linear regression analysis to correlate splitting tensile strength with the fibre reinforcing index. Linear relationship between splitting tensile strength and the flexural strength, split tensile strength and compressive strength were also proposed.

3. EXPERIMENTAL PROGRAMME

The materials used for preparing the polypropylene fibers , consists of required amount of cement, fine aggregate , coarse aggregate and polypropylene fibers .The materials are described separately as :-

3.2.1 CEMENT: The cement of Ordinary Portland cement 5 3 grade of Ambuja has been used in this experimental work. The tests were conducted on cement at the scheduled time after of 28 days as per IS 4031-1988. The various properties of the cement are described in Table 3.5.

3.2.2 FINE AGGREGATES: The fine aggregate used in this experimental work was the Locally available river sand passed through 4.75mm IS sieve has been used in the preparation of polypropylene fibre concrete . . The physical Properties of sand like Fineness Modulus ,Specific Gravity and water absorption are 3.49, 2.67 and 2.31% respectively.

3.2.3 COARSE AGGREGATES: Coarse aggregate used in this experimental work was selected from the locally quarry and the maximum size of the aggregate was 20 mm with specific gravity 2.89 and fineness modulus of 2.32 respectively

3.2.4 POLYPROPYLENE FIBRE: Polypropylene fibre is the synthetic material and was used in this experimental work .It is light in weight, strong and is flexible .It is also called as PP and comes in the group of polyolefin and is partially crystalline.

3.2.5 WATER: - water used in this experimental work was free from the foreign materials like chemicals, Salts and other impurities. This type of water was used for various concreting operations and all the code provisions were take into consideration

