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Literature Review of Polypropylene Fiber in M-50 Grade of Concrete in different Proportions

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Abstract - The paper deals with the effects of addition of various proportions of polypropylene fibers on the properties of High strength concrete. An increase in shear strength and flexural strength was found. The main aim of the investigation program was to first prepare the strength of concrete of grade M50 with locally available ingredient and then to study effects of different proportion of Polypropylene fiber and find optimum range of Polypropylene fiber content is 0.5%,1.0%,1.5% in the mix. The concrete specimens were tested at different age level for mechanical properties of concrete, namely, cube compressive strength, flexural strength and other test were conducted for cement, chemical admixture, coarse aggregate & fine aggregate. The study hence gave a significant reduction in settlement and drying shrinkage without having any significant change in compressive strength for the concrete mixes reinforced with fiber. Further, an improved abrasion resistance for the concrete mixes reinforced with fiber was also observed.

Keywords: Concrete; synthetic fiber; drying shrinkage; settlement; abrasion resistance.

INTRODUCTION

Last four decades, the polymeric materials are used to resist weathering action, chemical attack, abrasion and other degradation processes during the life of structure. In general, the reinforcement of brittle building materials with fibers has been known from ancient period such as putting straw into the mud for housing walls or reinforcing mortar using animal hair etc. Many materials like jute, bamboo, coconut, rice husk, cane bagasse, and sawdust as well as synthetic materials such as polyvinyl alcohol, polypropylene (PP), polyethylene, polyamides etc. have also been used for reinforcing the concrete .The concrete mixture with polypropylene fiber results in the fewer rate of bleeding and segregation as compared to plain concrete. This is because the fibers hold the concrete together and thus slow down the settlement of aggregates. The fibers also distribute these tensile stresses more evenly throughout the concrete. The mixture which is prepared from PP fiber increases the compressive and tensile strength. Crack also play an important role as they change concrete structures into permeable elements and consequently with a high risk of corrosion. Cracks makes the structure aesthetically unacceptable as well as reduce the life of structure. Therefore, to reduce cracks we should have to add PP fiber in concrete.

Casting: Casting consists of lying of concrete made from proper proportion of cement, sand and aggregate with required water cement ratio. Casting itself has its proper sequence which is to be followed. Casting can be done either by hand mixing or also by concrete mixture machine. Mostly batching plant is used when the mass concreting work is involved. In such cases, special type of RMC (Ready Mix Concrete) vehicle is needed .Four experimental work, casting was done on following steps: Casting 0f parent specimen.

Material: Materials used in this experimental work includes Ordinary Portland cement (43 grade), crushed coarse aggregate of size of 10 mm and 20 mm, river sand, silica fume, tap water, Conplast SP430G8 High-Range Water-Reducing Admixture and also polypropylene fibers. The short description of the materials used in the study is given below.

Cement: The cement used is Ordinary Portland cement (53Grade) having specific gravity of 3.15. the Initial and the final setting times of the cement were 69 min and 195 min, respectively. Its chemical composition is given in Table 1.

Table 1: Chemical composition of cement. (%)

Oxide	Cement
SiO2	19.71
Al2O3	5.20
Fe2O3	3.73
CaO	62.91
MgO	2.54
SO3	2.72
K2O	0.90
Na2O3	0.25
LOI	0.96

Aggregate:

1. Fine Aggregate (Sand):

Good quality river sand was used as a fine aggregate. Ref. Code : IS: 383 & 2386

Table 3: Results of tests on Fine Aggregate

Description	Results
Fineness Modules	3.50
Zone	II
Water Absorption	2.10
Specific Gravity	2.59
Silt Content	1.00

2. Coarse Aggregate: Ref. Code: IS: 2386 & 383

Table 4: Results of tests on Coarse Aggregate

Tests	Results
Coarse aggregate (kapchi)	
Water Absorption	1.80
Specific Gravity	2.77
Impact Value	10.70
Crushing Value	13.90
Coarse Aggregate (Grit)	
Water Absorption	2.10
Specific Gravity	2.78

1. TEST METHODLOGY

According to the feasibility of experimental set-up and laboratory conditions, we have adopted the size of the concrete specimen as 150 x 150 x 150 mm. First of all, casting of approximately 27 numbers of specimens was carried out and was kept for the curing period of 28 days. Concrete grade of M50 and water-cement ratio of 0.4 was adopted. Total 27 numbers of specimens were casted of which 09 cubes were casted using normal design and remaining 09 numbers were constructed using standard polypropylene fibres and the remaining 09 were casted using double the concentration of fibres.

Application of load was undertaken with the help of Digital Compressive .there are different methods of testing.

2. TESTING PROGRAMME:

1. Compressive Strength:

The cube specimen was placed in the machine, having capacity 2000kN. Then the load was applied at an rate of approximately 140 kg/sq.cm/min unless the resistance of the specimen to the increasing load can be sustained, and was shown in Figure 1.

Figure 1: Test for Compressive Strength

2. Flexural Strength:

The specimen was placed in the machine in such a manner that the load was applied to the uppermost surface as cast in the mold, along two lines spaced 13.33cm apart. The axis of the specimen was carefully aligned with the axis of the loading device. The load was applied through two similar steel rollers, 38mm in diameter, mounted at the third points of the supporting span that is spaced at 13.33cm centre to centre. The load was applied with out shock and increasing continuously at a rate of 180 kg/min until the specimen filed. Test results are presented in Table 6.The failure pattern has been presented in Figure 2.

Figure 2: Test for Flexural Strength of Concrete

3. Splitting Tensile Strength:

The cylinder specimen was placed in horizontal pattern in the centering with packing or loading pieces carefully positioned along the top and the bottom of the plane of loading of specimen. The load was also applied without shock and also increased continuously at a nominal rate with in the range 1.2 N/mm2/min to 2.4 N/mm2/min until failure of the specimen. The maximum load applied was recorded after failure. Appearance of concrete and unused features in the type of failure were also observed are shown in Figure 3.The test results are presented in Table 7.

Figure 3: Test for Splitting Tensile Strength

3. Mix Design

The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required, strength, durability, and workability as economically as possible, is termed the concrete mix design. The proportioning of ingredient of concrete is governed by the required performance of concrete in 2 states, namely the plastic and the hardened states. If the plastic concrete is not workable, it cannot be properly placed and compacted. The property of workability, therefore, becomes of vital importance. The compressive strength of hardened concrete which is generally considered to be an index of its other properties, depends upon many factors, e.g. quality and quantity of cement, water and aggregates; batching and mixing; placing, compaction and curing. The cost of concrete is made up of the cost of materials, plant and labour. The variations in the cost of materials arise from the fact that the cement is several times costly than the aggregate, thus the aim is to produce as lean a mix as possible. From technical point of view the rich mixes may lead to high shrinkage and cracking in the structural concrete, and to evolution of high heat of hydration in mass concrete which may cause cracking. Performance of Polypropylene Fibre Reinforced .The actual cost of concrete is related to the cost of materials required for producing a minimum mean strength called characteristic strength that is specified by the designer of the structure. This depends on the quality control measures, but there is no doubt that the quality control adds to the cost of concrete. The extent of quality control is often an economic compromise, and depends on the size and type of job. The cost of labour depends on the workability of mix, e.g., a concrete mix of inadequate workability may result in a high cost of labour to obtain a degree of compaction with available equipment.

4. LIMITATION

I. Avoid micro cracks in concrete.
II. Improved closed surface of concrete
III. Excellent crack reduction in early-age concrete.
IV. Better concrete durability & reduced surface dusting.
V. Improves mix cohesiveness.
VI. Significant improvement in freeze-thaw cycle resistance.
VII. It is poor with fire resisting properties
VIII. It probably decreases the shear strength of concrete.

5. CONCLUSIONS

I. In this project, we compared the strength of M-50 grade concrete cubes with that of cubes casted using polypropylene fibers in different proportions.
II. The compressive strength was compared of the cubes prepared.
III. we found out that cubes prepared using 15g of polypropylene fibers in concrete gave good compressive strength
IV. we suggest that since the strength of concrete increases with the addition of fiber, fibers can be added to the concrete for the structure and it can be used in the construction of high rise buildings, bridges etc.
V. Suitability of Concrete Reinforced with Synthetic Fiber for the Construction of Pavements.

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