Strengthing of Concrete Using Different Fibers

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Abstract: The capability of durable structure to resist weathering action, chemical attack, abrasion and other degradation processes during its service life with the minimal maintenance is equally important as the capacity of a structure to resist the loads applied on it. Although concrete offers many advantages regarding mechanical characteristics and economic aspects of the construction, the brittle behavior of the material remains a larger handicap for the seismic and other applications where flexible behaviour is essentially required.

Keywords—polypropylene fibres, glass fibres, Normal concrete

INTRODUCTION TO POLYPROPYLENE FIBRES

Ceramics were the first engineering materials known to mankind and they still constitute the most used materials in terms of weight . Hydraulic cements and cement-based composites including concretes are the main ceramic-based materials. Concrete offers many advantages in the application due to its improved mechanical characteristics, low permeability and higher resistance against chemical and mechanical attacks. Although concrete behavior is governed significantly by its compressive strength, the tensile strength is important with respect to the appearance and durability of concrete. The tensile strength of concrete is relatively much lower. Therefore, fibers are generally introduced to enhance its flexural tensile strength, crack arresting system and post cracking ductile behaviour of basic matrix.

Concrete modification by using polymeric materials has been studied for the past four decades . 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. Research and development into new fiber reinforced concrete is going on today.

Properties of Polypropylene Fibers

The raw material of polypropylene is derived from monomeric C3H6 which is purely hydrocarbon. Its mode of polymerization, its high molecular weight and the way it is processed into fibers combine to give polypropylene fibers very useful properties as explained below :

There is a sterically regular atomic arrangement in the polymer molecule and high crystallinity. Due to regular structure, it is known as isotactic polypropylene.

Chemical inertness makes the fibers resistant to most chemicals. Any chemical that will not attack the concrete constituents will have no effect on the fiber either. On contact with more aggressive chemicals, the concrete will always deteriorate first.

Lietarature review

Role of Fibers

Cracks play an important role as they change concrete structures into permeable elements and consequently with a high risk of corrosion. Cracks not only reduce the quality of concrete and make it aesthetically unacceptable but also make structures out of service. If these cracks do not exceed a certain width, they are neither harmful to a structure nor to its serviceability. Therefore, it is important to reduce the crack width and this can be achieved by adding polypropylene fibers to concrete. The bridging of cracks by the addition of PPfibers

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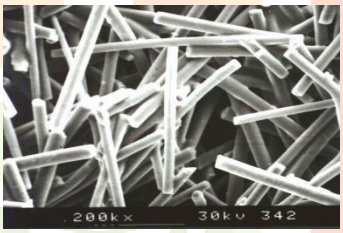
Thus addition of fibers in cement concrete matrix bridges these cracks and restrains them from furtheropening. The major reasons for crack formation are Plastic shrinkage, Plastic settlement, Freeze thaw damage, Fire damage etc.

Table 1: Properties of various types of polypropylene fibers

Fiber type	Length (mm)	Diameter (mm)	Tensile strength (MPa)	Modulus of elasticity (GPa)	Specific surface (m2/ kg)	Densit y (kg/c m3)
monofilament	30-50	0.30-0.35	547-658	3.50-7.50	91	0.9
microfilament	12-20	0.05-0.20	330-414	3.70-5.50	225	0.91
Fibrillated	19-40	0.20-0.30	500-750	5.00-10.00	58	0.95

Introduction Glass fibres:

Glass fiber-reinforced concrete consists of highstrength, alkali-resistant glass fiber embedded in a concrete matrix.In this form, both fibers and matrix retain their physical and chemical identities, while offering a synergistic combination of properties that cannot be achieved with either of the components acting alone. In general, fibers are the principal load-carrying members, while the surrounding matrix keeps them in the desired locations and orientation, acting as a load transfer medium between the fibers and protecting them from environmental damage. The fibers provide reinforcement for the matrix and other useful functions in fiber-reinforced composite materials. Glass fibers can be incorporated into a matrix either in continuous or discontinuous (chopped) lengths.



EXPERIMENTAL PROGRAMME

MATERIALS USED

The different materials used in this work are

1.Portland pozzolana cement (withflyash based)
2.Fine aggregates
3.Coarse aggregates
4.Fibres like glass and polypropylene
5.Water This program consists of casting and testing of total 9 specimens.The specimens of standard cubes(150mm x 150mm x 150mm) were casted for 7 and 28days for compressive strength of concrete.

Discussion of results

Tests on cement

TESTS	Result
Fineness of cement	1.70%
Specific gravity	2.396

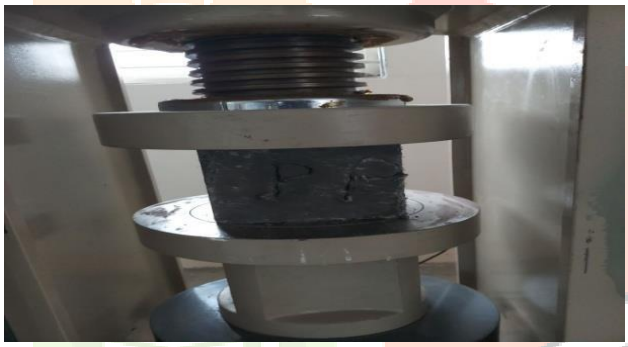
Tests on concrete

Sample No.	Load (KN)	Area(mm^2)	Compressive Strength (N/mm^2)
1	740	22500	32.88
2	790	22500	35.11
3	760	22500	33.77

TESTS	**Slump in mm**
Normal concrete	80mm
Concrete with polypropylene fibre	70mm
Concrete with glass fibres	95mm

COMPRESSIVE STRENGTH

Out of many tests applied to the concrete, this is the outmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether concreting has been done properly or not. For cube test two types of specimens either cubes of 15cm x 15cm x 15cm or 10cm x 10cm x 10cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15cm x 15cm x 15cm are commonly used.



7 Days

Compressive strength=33.92 N/mm^2

28 Days

Sample No.	Load (KN)	Area(mm^2)	Compressive Strength (N/mm^2)
1	980	22500	43.55
2	1210	22500	53.77
3	810	22500	36

Compressive strength=44.44 N/mm^2

Compressive Strength of Normal Concrete and

Glass fiber.(7Days)

Sample No.	Load (KN)	Area(mm^2)	Compressive Strength (N/mm^2)
1	545	22500	24.22
2	650	22500	28.88
3	595	22500	26.44

Compressive strength= 26.51N/mm^2

28 Days

Sample No.	Load (KN)	Area(mm^2)	Compressive Strength (N/mm^2)
1	1160	22500	51.55
2	860	22500	38.22
3	900	22500	40

Compressive Strength=43.25 N/mm^2

Compressive Strength of Normal and Polypropylene Fiber (7 Days)

Sample No.	Load (KN)	Area(mm^2)	Compressive Strength (N/mm^2)
1	625	22500	22.77
2	635	22500	28.22
3	625	22500	29.11

Compressive Strength=28.36 N/mm^2

28 Days

Sample No.	Load (KN)	Area(mm^2)	Compressive Strength (N/mm^2)
1	1170	22500	52
2	1150	22500	51.11
3	1180	22500	52.44

Compressive Strength=51.85 N/mm^2

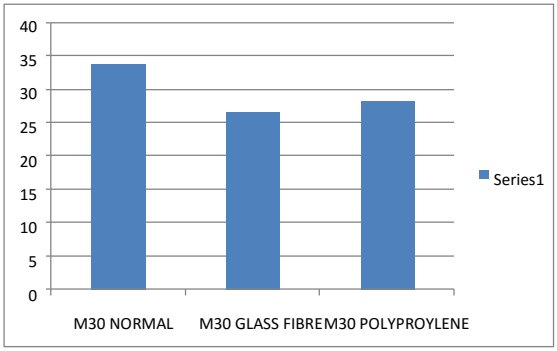
Compressive Strength Comparision (7Days)

S.No.	Normal (KN)	Glass (KN)	Polypropylole (KN)
1	740	545	625
2	790	650	635
3	760	595	655
Average	76333	596.66	636.66
Compressive Strength(N/mm^2)	33.92	26.50	28.36

28Days

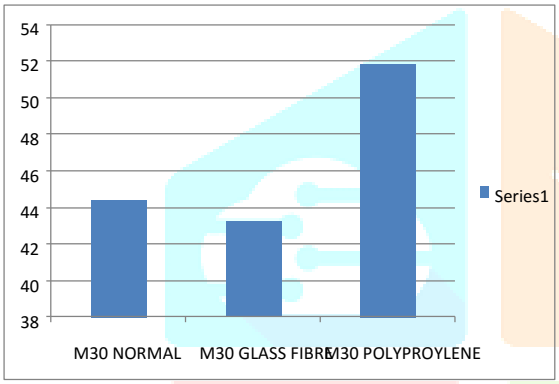
S.No.	Normal (KN)	Glass (KN)	Polypropylole (KN)
1	980	1160	1170
2	1210	860	1150
3	810	900	1180
Average	1000	973.33	1166.66

TYPES OF CONCRETE VS COMPRESSIVE STRENGTH OF CONCRETE FOR 7 DAYS



TYPES OF CONCRETE VS COMPRESSIVE

STRENGTH OF CONCRETE FOR 28 DAYS



CONCLUSION:

From the above figure's it can be seen clearly that initial strength i.e; 7 days strength of M30 grade normal concrete is high when compared to normal concrete with glass fibre and polypropylene fibre. It is happen irregular curing condition there is a linear variation in strength

For the 28 days strength of polypropylene fibre is high when compared to normal concrete and glass fibre

The addition of polypropylene fibres to the mix increases the shear strength.A fibre reduces the crack spacing thus indicating a more redistribution of stresses.

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