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Flexural Strengthening Of Reinforced Concrete Using Fibrillated Polypropylene Fibre

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ABSTRACT
The Fibrillated Polypropylene Fiber Reinforced Concrete is an economical construction material. To study the compressive strength, flexural strength and tensile strength of fibrillated polypropylene fiber reinforced concrete (FPPRC) containing fibers of 0.0%, 0.5%, 1.0% and 1.5% volume fraction of fibrillated polypropylene fibers, not only optimum utilization of materials is achieved but also the cost reduction is achieved. However, the development of fibrillated polypropylene fiber-reinforced concrete (FPPFRC) has provided a technical basis for arresting the cracks, provides the flexural strength deficiencies. This paper presents an overview of the effect of Fibrillated polypropylene (FPP) fibers on various properties of concrete in fresh and hardened state such as compressive strength, flexural strength, workability. A result data is also been compared between three different fibers strength.

I. INTRODUCTION

1.1 GENERAL
Concrete is characterized by quasi-brittle failure, the nearly complete loss of loading capacity, once failure is initiated. This characteristic, which limits the application of the material, can be overcome by the inclusion of a small amount of short randomly distributed fibers (steel, glass, synthetic and natural) and can be practiced among others that remedy weaknesses of concrete, such as low growth resistance, high shrinkage cracking, low durability, etc. Fiber reinforced concrete is the composite material containing fibers in the cement matrix in an orderly manner or randomly distributed manner. Its properties would obviously, depend upon the efficient transfer of stress between matrix and the fibers, which is largely dependent on the type of fiber, fiber geometry, fiber content, orientation and distribution of the fibers, mixing and compaction techniques of concrete, and size and shape of the aggregate. Fiber reinforced concretes (FRC) exhibit property improvement caused by the fibers. Fibrillated Polypropylene fibers have great influence on the spalling behavior of concrete under fire loading. Fibers of Fibrillated Polypropylene form a mesh or net type structure which binds the coarse aggregates in it, resulting in good workability and less bleeding of concrete. They also lower the permeability of concrete Fibrillated Polypropylene fibers give very good impact resistance strength to the concrete matrix. This property is very well utilized in concrete pavement successfully. Fibrillated Polypropylene fibers actually inhibit the formation of cracks in concrete matrix, whereas steel mesh only has functional value after the concrete has cracked. These materials are an excellent option for use as external reinforcing because of their light weight, resistance to corrosion, and high strength. Fibrillated polypropylene fibers are slit and expanded into an open network thus offering a larger specific surface area with improved bond characteristics. Polypropylene fibers are hydrophobic, that is they do not absorb water. Therefore, when placed in a concrete matrix they need only be mixed long enough to insure dispersion in the concrete mixture. The mixing time of fibrillated or tape fibers should be kept to a minimum to avoid possible shredding of the fibers. The type of polypropylene fiber recommended by manufacturers for paving applications is the collated fibrillated fiber . The length of fiber recommended is normally tied to the nominal maximum size of aggregate in the mixture. Manufacturers recommend that the length of the fiber be greater than twice the diameter of the aggregate. This would be consistent with past experiences with fibrillated polypropylene fibers and also with current theories on fiber dispersion and bonding". Hence this study explores the feasibility of fibrillated polypropylene fiber reinforcement; aim is to do parametric study on

compressive strength and tensile strength study etc. with given grade of concrete, proportions and percentage of fibers. 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 as well. Polypropylene fibers were first suggested as an admixture to concrete in 1965 for the construction of blast resistant buildings for the US Corps of Engineers. The fiber has subsequently been improved further and at present it is used either as short discontinuous fibrillated material for production of fiber reinforced concrete or a continuous mat for production of thin sheet components. Since then the use of these fibers has increased tremendously in construction of structures because addition of fibers in concrete improves the toughness, flexural strength, tensile strength and impact strength as well as failure mode of concrete. Polypropylene twine is cheap, abundantly available, and like all manmade fibers of a consistentquality.

1.2 PROPERTIES OF FIBRILLATED POLYPROPYLENEFIBERS

The raw material of polypropylene is derived from monomer 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:

1. There is a statically regular atomic arrangement in the polymer molecule and high crystallinity. Due to regular structure, it is known as isotacticpolypropylene
2. 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 deterioratefirst.
3. The hydrophobic surface not being wet by cement paste helps to prevent chopped fibers from balling effect during mixing like other fibers.
4. The water demand is nil for polypropylene fibers.
5. The orientation leaves the film weak in the lateral direction which facilitates fibrillations. The cement matrix can therefore penetrate in the mesh structure between the individual fibrils and create a mechanical bond between matrix and fiber.

Fig.1.1. Fibrillated fiber

The fibers are manufactured either by the pulling wire procedure with circular cross section or by extruding the plastic film with rectangular cross-section. They appear either as fibrillated bundles, mono filament or microfilaments as shown in Fig. 1. The fibrillated polypropylene fibers are formed by expansion of a plastic film, which is separated into strips and then slit. The fiber bundles are cut into specified lengths and fibrillated. In monofilament fibers, the addition of buttons at the ends of the fiber increases the pull out load. Further, the maximum load and stress transfer could also be achieved by twisting fibers.

1.3 ADVANTAGES OFFIBERS

- Improved long-term serviceability of the structure orproduct
- Highductility
- Prevents the occurrence of large crackwidths

- Increases matrix tensile strength at high volume percentages offibers
- Results in saving of expensive mortar, cement andsand
- Reduces crack during plastic and hardeningstage
- Reduces water seepages and protects steel in concrete from corrodingand
- Walls fromdampening
- Protects corners in precast slabs and concreteflooring
- Increases abrasion resistance by over 40% thereby increasing life ofroads,
- Walkways andfloors.
- Reduces pitting offloor

1.4 APPLICATIONS OFFIBERS

- Rock slope stabilization and support of excavated foundations inconjunction
- with rock and soil anchorsystems
- Industrial floorings, road pavements, warehouses, channellinings
- Protect bridge abutments
- Rehabilitation of deteriorated marine structures such as light stations,bulk
- heads, piers, sea walls and drydocks
- Slip-formed cast-in-place tunnellinings
- RCC & PCC like lintel, beam, column, flooring and plasteringwalls
- Hollow blocks and precast
- Manhole cover, tanks andtiles

1.5 ROLE OFFIBERS

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, the yare 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 Thus addition of fibers in cement concrete matrix bridges these cracks and restrains them from further opening. In order to achieve more deflection in the beam, additional forces and energies are required to pull out or fracture the fibres. This process, apart from preserving the integrity of concrete, improves the load-carrying capacity of structural member beyond cracking.. Reinforcing steel bars in concrete have the same beneficial effect because they act as long continuous fibres. Short discontinuous fibbers have the advantage, however, of being uniformly mixed and dispersed through out the concrete. The major reasons for crack formation are Plastic shrinkage, Plastic settlement, Freeze thaw damage, Fire damage etc.

1.6 PLASTICSHRINKAGE:

It occurs when surface water evaporates before the bleed water reaches the surface. Polypropylene fibers reduce the plastic shrinkage crack area due to their flexibility and ability to conform to form. The addition of 0.1% by volume of fibers is found effective in reducing the extent of cracking by a factor of 5-10. The extent of crack reduction is proportional to the fiber content in the concrete.

Table 1.1: Properties of various types of polypropylene fibers

Fiber type	Length (mm)	Diameter (mm)	Tensile strength (MPa)	Modulus of elasticity (GPa)	Specific surface (m2/kg)	Density (kg/cm3)
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

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Plastic settlement: High rate of bleeding and settlement combined with restraint to settlement (e.g. by reinforcing bars) leads to settlement cracking. In case of FPPRC, fibers are uniformly distributed. Fibers are flexible so they cause negligible restraint to settlement aggregates.

Freeze thaw damage: Small addition of polypropylene fibers in concrete reduces the flow of water through the concrete matrix by preventing the transmission of water through the normal modes of ingress, e.g. capillaries, pore structure, etc. The implications of these qualities in concrete with polypropylene fiber additions are that cement hydration will be improved, separation of aggregate will be reduced and the flow of water through concrete that causes deterioration from freeze/ thaw action and rebar corrosion will be reduced, creating an environment in which enhanced durability may take place.

1.7 PROPERTIES OF FPP FIBER REINFORCEDCONCRETE

Before mixing the concrete, the fiber length, amount and design mix variables are adjusted to prevent the fibers from balling. Good FRC mixes usually contain a high mortar volume as compared to conventional concrete mixes. The aspect ratio for the fibers are usually restricted between 100 and 200 since fibers which are too long tend to "ball" in the mix and create workability problems. As a rule, fibers are generally randomly distributed in the concrete; however, placing of concrete should be in such a manner that the fibers become aligned in the direction of applied stress which will result in even greater tensile and flexural strengths. There should be sufficient compaction so that the fresh concrete flows satisfactorily and the PP fibers are uniformly dispersed in the mixture. The fibers should not float to the surface nor sink to the bottom in the fresh concrete. Chemical admixtures are added to fiber-reinforced concrete mixes primarily to increase the workability of the mix. Air-entraining agents and water-reducing admixtures are usually added to mixes with a fine aggregate content of 50% or more. Super plasticizers, when added to fiber- reinforced concrete, can lower water: cement ratios, and improve the strength, volumetric stability and handling characteristics of the wet mix. Polypropylene fibers are used in two different ways to reinforce cementitious matrices. One application is in thin sheet components in which polypropylene provides the primary reinforcement. Its volume content is relatively high exceeding 5%, in order to obtain both strengthening and toughening. In other application the volume content of the polypropylene is low, less than 0.3% by volume, and it is intended to act mainly as secondary reinforcement for crack control, but not for structural load bearing applications. The performance and influence of the polypropylene fibers in the fresh and hardened concrete is different and therefore these two topics are treated separately.

II. LITERATURE REVIEW

Vikrant s. et al Critical investigation for M-20 grade of concrete to study the compressive strength, flexural strength and tensile strength of fibrillated polypropylene fiber reinforced concrete (PFRC) containing fibers of 0%, 0.25% and 0.4% volume fraction of fibrillated polypropylene fibers of 15mm, 20mm and 24mm length were used. For compression test, the cube (15cmx15cmx15cm) and Cylinders (10cm diameter and 20cm length) were used. For splitting Test, Cylinders (10 cm diameter and 20 cm length) were used. A result data obtained has been analyzed and compared with a control specimen (0% fiber). A result data also compared between three different fibers strength. A relationship between Compressive strength vs. days, and tensile strength vs. days represented graphically. Result data clearly shows percentage increase in7 and 28 days Compressive strength and Tensile strength for M-20 Grade of Concrete.

Dr.T.Ch.Madhavi et al., Polypropylene Fiber Reinforced Concrete is an embryonic construction material which can be described as a concrete having high mechanical strength, Stiffness and durability. By utilization of Polypropylene fibers in concrete not only optimum utilization of materials is achieved but also the cost reduction is achieved. This paper presents a comprehensive review on various aspects Polypropylene Fiber Reinforced Concrete concerning the behavior, applications And performance of Polypropylene Fiber Reinforced Concrete. Various issues related to the manufacture and strength of Polypropylene Fiber Reinforced are also discussed.

Mr. Mehul et al, The paper deals with the effects of addition of various proportions of polypropylene fibers on the properties of High strength concrete. An experimental program was carried out to explore its effects on compressive, tensile, flexural, shear strength and plastic shrinkage cracking. A notable increase in flexural, tensile and s hear strength was found. The main aim of the investigation program is first to prepare the strength of concrete of grade M40 with locally available ingredient and then to study the effect of different proportion of Polypropylene fiber in the mix and to 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 me chemical properties of concrete, namely, cube compressive strength, split tensile strength, flexural strength and other test were conducted for cement, chemical admixture, coarse aggregate & fineaggregate.

E. Mollaahmadi et al,In general, the behavior of most of materials is studied in terms of their mechanical properties like as compressive and tensile strengths; however, to study the behavior of fiber reinforced concrete, these properties is not enough and the flexural strength and the energy absorption capacity of the concrete should also be studied. The effect of polypropylene fibers of different lengths and diameters on the flexural strength of the concrete has been explored in this article. The variables of the experiments include three lengths for fine polypropylene fibers and two lengths for thick polypropylene fibers. Results indicate the flexural strength of the samples increased with increasing the fiber's length. But by addition fine polypropylene fibers, the flexural strength of the samples decreased with increasing the fiber's length. On the other hand, the addition of fibers polypropylene to the concrete can not be effective in enhancing the cracking load of the concrete, but thick polypropylene fibers can increases the ultimate load after cracking and the energy absorption capacity of the concrete.

MahendraPrasad et al, Concrete is the most widely used construction material because of its mould ability into any required structural form and shape due to itsfluid behavior at early ages. The objective of this research is to investigate the workability and flexural strength of cement concrete containing silica fume and polypropylene fibers. Properties studied include workability of the fresh mix and flexural strength of hardened concrete. Silica fume content used was 0%, 5%, 10% and 15% by replacement of equal weight of cement in concrete. Polypropylene fibers were added in 0%,0.20%, 0.40% and 0.60% by volume fraction of concrete. The experimental test results demonstrated that addition of polypropylene fibers at 0.4% Volume fraction showed considerable gain of flexural strength of 4.95 MPa and 7.32 MPa at 7 and 28 days respectively. The behavior of concrete under flexural loads was found to be consistently improved compared with reference mix design. Results show that the use of 10% silica fume combined with 0.40% fiber volume fraction results in optimum mixture design for applications from the standpoints of workability and flexural strength. Further, flexural strength at the ages of 7 and 28 was also determined and results are includedhere.

Ronald F. Zollo etal, Research and development regarding fiber reinforced materials (FRC) has evolved steadily with most notable progress having been made with the periodic introduction of new fiber types; including materials and form or shape. The attendant interest associated with new fibers has invariably led to an improved understanding of the mechanics of behavior of FRC and to new applications. The use of collated fibrillated polypropylene fibers (CFP) at low fiber volume improves many aspects of the production and application of FRC including mixing and placement. Plastic state rheological and hardened state mechanical behavior are quite different from those properties which have been reported in the literature for FRC systems usingrigidmetallicormorebrittleglassfibersandforwhichfibervolumesare normally about ten times the fiber volume of CFP fibers used in this research. A series of tests are designed to assess the basic properties of CFP fibrous concrete in both the plastic and hardened state. As much as possible these tests were conducted in accordance with recommended ASTM and ACI Committee 544 procedures including tests for compression, flexure, impact, split cylinder, and rebar pullout. Other specially designed tests include flexure of composite steel deck and concrete overlay specimens to affect the replacement of weld wire fabric in such applications, and shrinkage testing. Results indicate the benefit derived from the use of CFP fibers is significant as a secondary reinforcement and for crack control. A significant reduction in shrinkage is found and there are positive contributions in other strength performance areas.

III. METHODOLOGY

3.1 GENERAL

The methodology worked out to achieve the above-mentioned objectives is followed as shown in the flow chart below:

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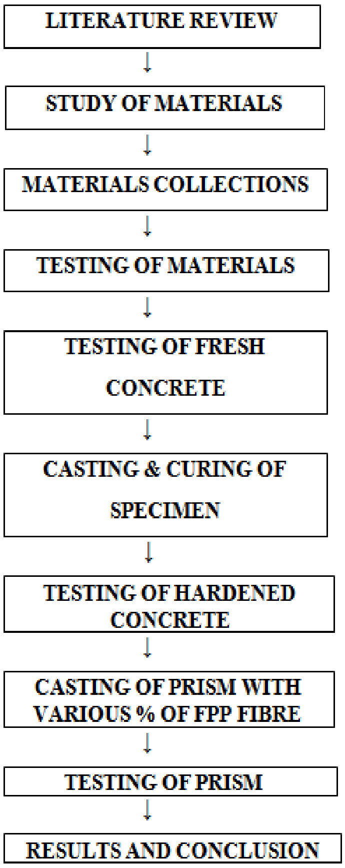

IV. MATERIALS

Cement, fine aggregates, coarse aggregates, reinforcing bars are used in casting of beams, and cement slurry with bonding agent for grouting is used for retrofitting of these beams. The specifications and properties of these materials are as under.

4.1.1 Cement

Ordinary Portland pozzolana cement of 53 grades from a single lot was taken for the study. The physical properties of cement as obtained from various tests are listed in Table 3.1. All the tests are carried out in accordance with procedure laid down in IS:8112-1989.

4.1.2 Fine Aggregates

The sand used for the experimental works was locally procured and conformed to grading zone III. Sieve Analysis of the Fine Aggregate was carried out in the laboratory as per IS 383-1870. The sand was first sieved through 4.75mm sieve to remove any particle greater than 4.75 mm sieve and then was washed to remove the dust. The physical properties results of sand are shown in Table3.7.

4.1.3 Coarse Aggregates

Crushed stone aggregate (locally available) of 20mm are used throughout the experimental study. The physical properties of coarse aggregate are given in Table 3.11.

4.1.4 Water

Fresh and clean water is used for casting the specimens in the present study. The water is relatively free from organic matter, silt, oil, sugar, chloride and acidic material as per Indianstandard.

4.1.5 Concrete Mix

M25 grade concrete is considered as nominal mix design using the properties of materials as discussed above i.e. Table 3.1 to Table 3.12.The mix proportion of material is 1:1:2 (cement: fine aggregate: coarse aggregate).

4.2 MATERIALTESTING

4.2.1 Test forCement

The following experiments were conducted to find the properties of cement as per IS-4031,

i. Standard ConsistencyTest
ii. Initial Setting and Final Setting TimeTest
iii. Specific GravityTest
iv. Compression Strength test for MortarCube

Table3.1 Standard Consistency of Cement

Weight of cement (gm)	Percentage of water added(in terms of weight of cement)	Volume of water added(ml)	Reading on gauge (mm)
400	25	100	30
400	27	108	27
400	29	116	21
400	31	124	13
400	33	132	8

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Fig.3.1 Vicat apparatus

Table 3.2 Initial Setting Time of Cement

Time at which water is added to cement(min)	Time at which the needle fails to pierce the test block by 5.0±0.5mm(min)	Initial setting time (min)
0	90	40

Table 3.3 Final Setting Time of Cement

Time at which water is added to cement(min)	Time at which the needle makes an impression on surface on surface of block(min)	Final setting time (min)
0	475	400

Table 3.4Specific Gravity of Cement

Sl.no	Description(gm)	Trial-1	Trial-2	Trial-3	Mean
1	Weight of empty bottle(w_1)	14	14	14	
2	Weight of bottle + Cement (w_2)	116	115	113	
3	Weight of bottle + Cement+ Kerosene (w_3)	312	309	311	3.15
4	Weight of bottle + Kerosene (w_4)	242	241	240	
5	Specific gravity of cement	3.18	3.06	3.22	

CALCULATION:

$$\text{Specific gravity of cement} = \frac{w2-w1}{(w_2-w_1)-(w_3-w_4)}$$

$$= \frac{116-14}{(116-14)-(312-242)}$$

$$= 3.18$$

Table 3.5 Compressive Strength of Mortar Cube

Sl.no	Period of curing(days)	Compressive strength(N/mm^2)
1	7	18.75
2	28	54.8

4.2.2 Test on FineAggregate

The following experiments were conducted to find out the properties of fine aggregate as per IS-2386,

4.2.2.1 Sieve Analysis Test
4.2.2.2 Specific GravityTest
4.2.2.3 Water Absorption Test

Fig.3.2 Sieve Analysis of Fine Aggregate

Table 3.6 Sieve Analysis of Fine Aggregate

Sl.No	Sieve Opening Size	Weight of F.A Retained (gm)	Cumulative Weight of F.A retained (gm)	Cumulative Percentage of F.A Retained (gm)	Cumulative percentage of F.Apassing
1	10mm	0	0	0	100
2	4.75mm	11	11	1.1	98.9
3	2.36mm	34	45	4.5	95.5
4	1.18mm	232	277	27.7	72.3
5	600µ	300	577	57.7	42.3
6	300µ	296	873	87.3	12.7
7	150µ	95	968	96.8	3.2
8	<150µ	20	988	-	-
		988		Total=275	

CALCULATION:

$$\text{Fineness Modules} = \frac{\text{Total cumulative \% weight retained}}{100}$$

= 275.1/100
= 2.75

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Fig.3.3 Specific gravity of fine aggregate

Table 3.7 Specific Gravity of Fine Aggregate

Sl.no	Description(gm)	Trial1	Trial2	Trial3	Mean
1	Weight of empty pycnometer (w_1)	663	663	663	
2	Weight ofpycnometer + FineAggregate(w_2)	861	857	863	
3	Weight of pycnometer + Fine Aggregate + water (w_3)	1669	169	1670	2.65
4	Weight of pycnometer + water (w_4)	1542	1547	1546	
5	Specific gravity of FA	2.788	2.59	2.60	

CALCULATION:

$$\text{Specific gravity of fine aggregate} = \frac{w2-w1}{[w2-w1]-[w3-w4]}$$

$$= \frac{861-663}{(861-663)-(1669-1542)}$$

$$= 2.788$$

Table 3.8 Water Absorption of Fine Aggregate

Sl.no	Description(gm)	Trial
1	Weight of saturated surface dry sample w_1	883
2	Weight of oven dry sample w_2	875.01
3	Water absorption	0.904%

CALCULATION:

$$\text{Water absorption} = \frac{w1-w2}{w1} X100$$

$$= \frac{883-875.01}{883} X\ 100$$

$$= 0.904\%$$

4.2.3 Test on Coarse Aggregate

The following experiments were conducted to find out the properties of coarse aggregate as per IS-2386,

i. Water absorption Test
ii. Impact Test
iii. Specific GravityTest
iv. Sieve Analysis Test

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Table 3.9 Water Absorption of Coarse Aggregate

Sl.no	Description(gm)	For size 20mm Aggregate
1	Weight oven dry sample(w_1)	1000
2	Weight of saturated Sample(w_2)	1012
3	Water absorption	1.2%

CALCULATION:

$$\text{Water absorption} = \frac{w2-w1}{w1} X100$$

$$= \frac{1012-1000}{1000} X\ 100$$

$$= 1.2\%$$

Table3.10 Impact of Coarse Aggregate

Sl.no	Description	Coarse aggregate			
		Trial-1	Trial-2	Trial-3	Mean
1	Weight of sample W_1(gm)	425	420	428	7.5%
2	Weight of passing after impacting W_2(gm)	32	31.7	32	
3	Aggregate Impact value	7.52%	7.54%	7.47%	

Fig .3.4 Impact test on Coarse Aggregate

CALCULATION:

$$\text{Aggregate Impact value} = \frac{w2}{w1} X\ 100$$

$$= \frac{32}{425} X100 \qquad = 7.52\%$$

Fig.3.5 Specific Gravity of Coarse Aggregate

Table 3.11Specific Gravity of Coarse Aggregate

Sl.no	Description(gm)	Trial-1	Trial-2	Trial-3	Mean
1	Weight of empty bottle (w_1)	665	665	665	
2	Weight of bottle + Coarse Aggregate(w_2)	866	860	865	
3	Weight of bottle + Coarse Aggregate + water (w_3)	1668	1669	1668	2.77
4	Weight of bottle + water (w_4)	1541	1542	1542	
5	Specific gravity of Coarse Aggregate	2.71	2.86	2.74	

CALCULATION:

$$\text{Specific gravity of coarse aggregate} = \frac{w2-w1}{[w_2-w_1]-[w_3-w_4]}$$

$$= \frac{866-665}{[866-665]-[1668-1541]}$$

$$= 2.71$$

Table 3.12 Sieve Analysis for Coarse Aggregate

Sl. No	I.S sieve size (mm)	Quantity retained (gm)	%retained	Cumulative percentage retained	Cumulative percentage passing
1.	40	-	-	-	-
2.	20	2458	49	49.3	50.7
3.	10	2525	51	99.6	0.35
4.	4.875	16	0.36	100	0
5.	Pan	-	-	100	-
Total CumulativePercentageRetained				=349.0	

Fig.3.6 Sieve Analysis of Fine Aggregat

CALCULATION:

$$\text{Fineness Modules} = \frac{\text{Total cumulative \% weight retained}}{100}$$
$$= \frac{349}{100}$$
$$= 3.49$$

Table 3.13 Summary Of Material Testing Results

Sl.No	Name of Test	Value	Codal Standard
1	Specific Gravity of Cement	3.15	3.15
2	Standard Consistency of Cement	30%	
3	Initial Setting Time of Cement	30min	IS 12269-1987 Should not be less than 30 minitues clause 5.3
4	Test on final setting time of cement	350min	IS 12269-1987 Should not be more than 600minitues clause 5.3
5	Average Compressive strength test of cement mortar cube (28days)	54.8N/mm^2	Not less than 53 N/mm^2 as perIS 12269-1987
6	Specific gravity of FA	2.65	2.6-2.7
7	Sieve analysis of FA	FM=2.755	Medium sand 2.6-2.9
8	Water absorption test on FA	0.903%	
9	Specific gravity test for CA	2.77	FOR C.A 2.7
10	Water absorption test for CA	1.2%	5%
11	Sieve analysis of CA	FM=3.49	
12	Impact test of CA	7.51%	Should not be > than 45% for concrete other than wearing surface and 30% for pavements as per IS 283-1970

5 5.1COMPRESSIVE STRENGTH

5.1.1COMPRESSIVE STRENGTH OF CONVENTIONAL CONCRETE CUBES

The compressive strength of the concrete mixes made with and without fibre was determined at 7,14 and 28 days of curing the test result as given Table and shown in fig,shows the variation of compressive for strength with age for various percentage fibrillated polypropylene fibre from the test results , it can be seen that the compressive strength of fibre 0%,0.5%,1.0% and 1.5% of cementweight.

Calculation the compressive strength on concrete cubes

Appliedload = 660KN

Areaof cube = 150x150mm

= $22500mm^2$

$$\text{Compressive strength on concrete} = \frac{Appliedload}{Areaofcube}$$

$$= \frac{660 \times 10^3}{22500}$$

$$= 29.3\ N/mm^2$$

Table:5.1 Compressive strength of concrete cube at 7 days

Percentage of fibre	Compressive load (KN)	Area(mm^2)	Compressive stress(N/ mm^2)
0%	640	150×150	28.0
0.5%	660	150×150	29.3
1.0%	660	150×150	29.3
1.5%	650	150×150	28.9

Table:5.2 Compressive strength of concrete cube at 14 days

Percentage of fibre	Compressive load (KN)	Area(mm^2)	Compressive stress(N/ mm^2)
0%	660	150×150	29.3
0.5%	690	150×150	30.7
1.0%	690	150×150	30.7
1.5%	670	150×150	29.8

Table:5.3 Compressive strength of concrete cube at 28 days

Percentage of fibre	Compressive load (KN)	Area(mm^2)	Compressive stress(N/ mm^2)
0%	690	150×150	30.7
0.5%	710	150×150	31.6
1.0%	720	150×150	32.0
1.5%	720	150×150	32.0

Table:5.4 Compressive strength of concrete cube

Specimen	W/C ratio	7 days N/mm^2	14 days N/mm^2	28 days N/mm^2
0%		28.0	29.3	30.7
0.5%		29.3	30.7	31.6
1.0%		29.3	30.7	32.0
1.5%	0.5 %	28.9	29.8	32.0

5.2 FLEXURAL STRENGTH TEST

Flexural strength tests were conducted on standard beams of dimension 10cm x 10cm x 60cm , 3 specimens each for plain concrete and fibre reinforced concrete were cast at varying percentages of fibre (0.5%,1.0%, 1.5%). For each case the 28day strength values were obtained by loading under a apparatus for flexural strength. The result of Split tensile strength of plain and processed fibre reinforcedconcrete.

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Calculated the flexural strength on concrete prism

Lengthofprism =600mm
Widthofprism =100mm
Depthofprism =100mm

Flexural strength on concrete prism = $\frac{MY}{I}$

Bending moment

$$M = \frac{WL}{4}$$

$$= \frac{9 \times 10^3 \times 200}{4}$$

$$= 450 \times 10^3 Nmm$$

Moment of inertia

$$I = \frac{bd^3}{12}$$

$$= \frac{100 \times 100^3}{12}$$

$$= 8.33 \times 10^6 mm^4$$

Flexural strength of concrete

$$F = \frac{450 \times 10^3 \times 50}{8.33 \times 10^6}$$

Table: 5.5 Flexural strength of prism at 14 days

Percentage of fibre	Applied load (KN)	Moment of inertia (mm^4)	Flexural stress (N/mm²)
0%	9	8.33×10^6	2.70
0.5%	9	8.33×10^6	2.70
1.0%	6	8.33×10^6	1.80
1.5%	10	8.33×10^6	3.00

Table:5.6 Flexural strength of prism at 28 days

Percentage of fibre	Applied load (KN)	Moment of inertia (mm^4)	Flexural stress (N/mm²)
0%	9	8.33×10^6	2.85
0.5%	9	8.33×10^6	3.00
1.0%	6	8.33×10^6	4.50
1.5%	10	8.33×10^6	5.70

Table :5.7 Flextural strength of various % of fibre prism

Specimen	W/C ratio	14 days N/mm²	28 days N/mm²
Ordinary concrete	0.5 %	2.70	2.85
0.5% fiber		2.70	3.00
1.0% fiber		1.80	4.50
1.5% fiber		3.00	5.70

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V. CONCLUSION

The various literature reviews have been studied to gain knowledge about my project. Materials have been chosen which satisfied the various properties like cement, fine aggregates and coarse aggregates. The material test and testing of properties of fiber have been done. The fiber concrete is tested with the cube, cylinder and prism and will be implemented with beam in future. The fiber will be added in different proportions and the test results will becompared.

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