EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES OF CONCRETE USING RECRON 3S FIBER

A. Suma[1], N. Veerendra Babu [2]
Department of Civil Engineering
[1] Student, M.tech Srinivasa institute of engineering and technology
[2]Assistant professor, Srinivasa institute of engineering and technology

Abstract- *Concrete is a versatile engineering material used in most civil engineering structures, so great attention is required to improve the concrete property by improving its strength and durability. In the current scenario, Recron-3s, which is a polypropylene monofilament short fiber strings that can be used in concrete are used to control and stop cracks. In this study, an attempt has been made to study the different mechanical properties of concrete consisting of Recron 3S fibers. The proportions of the mixture were casted with M40 and M45 grade concrete.*

For strength parameters compressive strength, split tensile strength and flexural strength were performed on hardened concrete of M40 grade and M50 grade with combination of Recron 3S fiber of varying percentages i.e. 0%, 0.25%, 0.50%, 0.75% to that of cement weight at the age of 28 days and the test results were compared. It is observed that the concrete combined with Recron 3s fiber have the maximum compressive strength, split tensile strength and flexural strength when Recron3s fiber content is 0.25% after 28 days curing.

Key words: Cement, Recron 3S fiber, Workability, Compressive strength, Split tensile strength, Flexural strength, M40, M45, Polypropylene.

I. INTRODUCTION

1.1 GENERAL

The most popular, cost-effective, and versatile building material is concrete. It gained popularity as a basic building material in construction due to its economy, good durability, ease to manufacture, ability to mould into required shape and size, and due to its high compressive strength.

1.2 OBJECTIVE OF THE PROJECT

- To investigate effect of Recron 3S on tensile and flexural strength of concrete.
- Checking the impact of Recron3s fibers on the concrete compression strength.
- Determine the optimum effective dose of Recron 3S fibers for use in concrete.

1.3 NEED FOR THE PRESENT STUDY

Failure of the civil structures is primarily due to the corrosion of steel with salt, which leads to its deterioration. Constant maintenance and repair is needed to improve the life span of these civilian structures. To reduce the failure of the steel reinforced concrete structures, the following approach is generally followed. This approach includes adhesive bonding of the polymer fiber compounds to the structure.

1.4 SCOPE OF WORK

Experimental work was carried out to obtain the compressive, split tensile strength and flexural strength for normal and Recron3S fiber reinforced concrete. The obtained results are tabulated, analyzed and their performance is studied.

II. LITERATURE REVIEW

Many researchers have investigated the effect of various types of fibers on the mechanical properties of concrete. However, Recron 3s polyester fiber reinforced concrete is a new topic in concrete construction world and researches done on it are limited.

Thirumurugan and Sivakumar (2013) reported that the addition of fibers has greater control over concrete failure patterns and that irregular fiber orientation improves the breaking properties of concrete. Adding fibers to concrete provides better ductile properties and helps to withstand more loads before and after peak failure.

III. THEORY

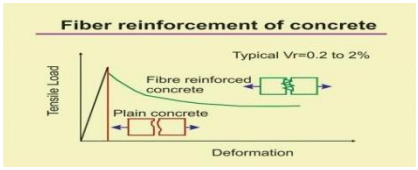
3.1 FIBER REINFORCED CONCRETE (FRC):

3.1.1 Introduction:

The concrete which contains concrete fibrous material due to which its structural integrity gets increased is known as Fiber reinforced concrete (FRC). It contains short discrete fibers that are uniformly distributed and randomly oriented.

3.1.2 Effects of fibers on concrete

The amount of fibers added to a concrete mix is measured as a percentage of the total volume of the composite (concrete and fibers) termed volume fraction (Vf). Vf typically ranges from 0.1 to 3%. By dividing the fiber length (l) by its diameter (d) Aspect ratio (l/d) is calculated. If the modulus of elasticity of the fiber is higher than the matrix (concrete or mortar binder), they help to carry the load by increasing the tensile strength of the material.



Tension versus deformation loads for fiber-reinforced and plain concrete

3.1.3 Necessity

1. The tensile strength of the concrete is increased.
2. The air voids and water voids in the inherent porosity of gel is reduced.
3. The durability of the concrete is increased.
4. Most of the resins do not have resistance to creep but for Fibers such as graphite and glass have excellent resistance to creep
5. The reinforcement acts as the strengthening fiber in the concrete matrix. The thermal stresses for the two materials are so similar that the differential deformations of concrete and the reinforcement are minimized.
6. The static and dynamic properties of the concrete would be increased by addition of small, closely spaced and uniformly dispersed fibers which acts as crack arrester

3.1.4 Factors affecting properties of fiber reinforced concrete

The properties of fiber reinforced concrete, depends upon the efficient transfer of stress between matrix and the fibers. The factors are briefly discussed below:

A) Relative Fiber Matrix Stiffness
B) Volume of Fibers
C) Aspect Ratio of the Fiber
D) Orientation of Fibers
E) Workability and Compaction of Concrete
F) Size of Coarse Aggregate
G) Mixing

3.1.5 DIFFERENT TYPES OF FIBER:

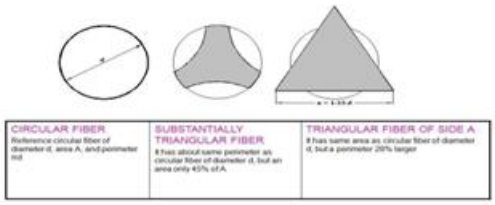
Following are the different type of fibers generally used in the construction industries.

1. Steel Fibers
2. Polypropylene Fibers
3. Glass Fibers
4. Asbestos Fibers
5. Carbon Fibers
6. Organic Fibers
7. Polyester Fibers

3.2 RECRON 3S FIBER:

3.2.1 Introduction:

Recron 3S is a secondary reinforcement product for construction developed in house by Reliance Industries Limited at State of Art R&D facility at Patalganga. Advantage of its substantially triangular shape is described below with the help of figure:



Shape of Recron 3S fiber

Recron 3S is environmental and nonhazardous. It easily disperses and separates in the mix. Only 0.2-0.4% by cement Recron 3S is sufficient to get the advantage.

Recron 3S fibers

Samples of the Recron-3S Fiber

3.2.2 Manufacture of Recron 3S Fibers

Recron 3S is manufactured by polymerization of raw materials i.e. Pure Terephthalic Acid (PTA) and Mono Ethylene Glycol (MEG) using catalysts, which by a continuous extrusion process yields finished polyester (Recron 3S) yarn.

Chemical Composition of Recron 3S fiber

Chemical Identify	Concentration
Polymer (Polyethylene terephthalate)	>94.0%
Additives (Titanium dioxide, optical brighteners)	<0.5%
Spin finish	<0.5%
Hazardous ingredient	None

Type of Recron 3S

Type	Application	General Specification
CT2012	Plaster, Concrete	6 mm length, 125 gm packing
CT 2024	Concrete	12 mm length, 125 gm packing
CT2424	Ready mix concrete	12 mm length, 450 gm dissolvable packing

3.2.3 Properties of Recron 3S Fibers

A) Physical Properties

- Color: Available in white / white.
- Smell: Odorless
- Appearance/Form: chopped staple fibers
- Cross-section: Triangle
- Relative Density: 1.3-1.4 g/cm^3
- Length: Available in 6, 12 and 18 mm cut length.
- Diameter: The diameter of Recron 3S fiber varies from 30-40 microns

B) Chemical Properties

- Solubility: Recron 3S fibers are insoluble in common solvents.
- Water Solubility: Insoluble in Water.
- It has no oxidizing properties.
- Fibers Recron 3S fibers degrade when contacted with strong oxidizing agents.
- Toxicity: Very low.

- Recron 3S fiber is non-biodegradable.

C) Thermal Properties

- Melting point/range: 240-260 °C
- Softening point: 220 °C

D) Mechanical Properties

- Elongation: >100 %
- Recron 3S fibers are non-capillary and non-hygroscopic, giving good moisture resistance.
- Tensile strength: 4000-6000 kg/cm^2

3.3 RECRON 3S FIBER REINFORCED CONCRETE

3.3.1 Introduction:

Research and development work in Fiber Reinforced Concrete (FRC) composites began in India in the early 1970s.

Recron 3s FRC has been adopted by many construction industries across India, who has come to rely on its superior bonding and strengthening qualities. Here are a few figures:

- Added to over 15 million cu. m. of concrete and 25 million square feet of plaster in India
- Used and accepted by India's top 100 realty companies
- Adopted by over 60 precast manufacturers
- Experience speaks with:

3.3.2 Advantages of using Recron 3S in FRC:

- Increase the Post Peak Ductility of Concrete
- Reduce Water Percolation and Concrete Permeability
- Reduces Rebound losses by 50-70% in shotcrete
- Increases Abrasion Resistance by over 40%

3.3.3 Mixing of Recron 3S with concrete:

Mixing of Recron 3s fibers with concrete can be done by both machine mixing and manual mixing. In case of machine mixing, fibers are put in the mixer along with some water (5-10 liters) and then other ingredients are added and mixing is continued till entire fibers are dispersed in few minutes.

IV. METHODLOGY

4.1 GENERAL

The objective of the present work is to develop concrete with good strength, less porous, less capillarity so that durability will be reached.

- To determine the mix proportion of concrete to achieve the desire needs.
- To investigate different basic properties of concrete such as compressive strength, splitting tensile strength, flexural strength etc and comparing the results of different proportioning.
- Determination of porosity and capillary of different proportioned concrete.

4.2 MATERIALS USED

a) Cement:

The Ordinary Portland Cement "PENNA" of 53 grades is used specifying all the properties from IS: 12269-1987.

Cement

b) Coarse Aggregate:

20mm and 10mm coarse aggregate are selected by passing the aggregate through 20mm and 10mm sieves respectively. Coarse aggregate is dust free and free from surface moisture.

Coarse aggregate

c) Fine Aggregate:

Natural Sand is selected as fine aggregate. Sand is sieved from 4.75 mm sieve and also washed to reduce the silt content. The specific gravity, fineness modulus and water absorption test are conducted on Natural sand.

Fine aggregate

d) Super Plasticizers:

FosrocAuramix 400 is used as super plasticizers. Auramix 400 is a unique combination of the latest generation super plasticizers, based on a polycarboxylic ether polymer with long lateral chains.

e) Water:

Portable water, available in laboratory, is used for mixing and curing of concrete. Water is free from unwanted substances and chemical oxides.

Water

f) Recron 3S:

It is a modified polyester fiber manufactured by Reliance Industries Limited. Recron 3s fibers of 12 mm length are used.

V. MIX DESIGN

5.1 GENERAL

Characteristic strength is known as the actual cost of concrete. This depends on the quality control measures, but there is no doubt that the quality control adds to the cost of concrete. The cost of labour depends on the workability of mix.

5.2 REQUIREMENTS OF CONCRETE MIX DESIGN

The requirements which form the basis of selection and proportioning of mix ingredients are:

a) The minimum compressive strength required from structural consideration

b) The adequate workability necessary for full compaction with the compacting equipment available.

c) Maximum water-cement ratio to give adequate durability for the particular site conditions.

d) Maximum cement content to avoid shrinkage cracking due to temperature cycle in mass concrete.

Factors to be considered for mix design:

- The grade designation, (the characteristic strength requirement of concrete).
- The type of cement influences the rate of development of compressive strength of concrete.
- Maximum nominal size of aggregates to be used in concrete may be as large as possible within the limits prescribed by IS: 456-2000.
- The cement content is to be limited from shrinkage, cracking and creep. The workability of concrete for satisfactory placing and compaction is related to the size, shape, quantity and spacing of reinforcement and technique used for transportation, placing and compaction.

5.3MIX DESIGN OF M40 GRADE CONCRETE (AS PER IS: 10262-2009 AND IS: 456 -2000)

5.3.1 Required Data:

a) Grade designation: M40
b) Type of cement: OPC 53 grade, IS 8112
c) Max. Nominal size of agg.: 20 mm
d) Minimum cement content: 360 kg/m3
e) Maximum water cement ratio: 0.40
f) Degree of Workability: 100 mm slump
g) Climatic condition: Severe
h) Degree of supervision: Good
i) Type of aggregate.: Crushed angular aggregate
j) Chemical admixture: FosrocAuramix 400 Super Plasticizers

5.3.2Test data of materials

1. Cement used: OPC 53 grade
2. Specific gravity of cement: 3.156
3. Specific gravity of Coarse aggregate: 2.64
4. Specific Gravity of Fine aggregate: 2.61

5. Coarse aggregate: Conforming to Table 2 of IS 383
6. Fine aggregate: Conforming to Zone II of IS 383

5.4MIX DESIGN OF M45 GRADE CONCRETE (AS PER IS: 10262-2009 AND IS: 456 -2000)

5.4.1 Required Data:

a) Grade designation: M45
b) Type of cement: OPC 53 grade, IS 8112
c) Max. Nominal size of agg.: 20 mm
d) Minimum cement content: 320 kg/m3
e) Maximum water cement ratio: 0.40
f) Degree of Workability: 100 mm slump
g) Climatic condition: Severe
h) Degree of supervision: Good
i) Type of aggregate.: Crushed angular aggregate
j) Chemical admixture: FosrocAuramix 400 Super Plasticizers

5.4.2Test data of materials

1. Cement used: OPC 53 grade
2. Specific gravity of cement: 3.16
3. Specific gravity of Coarse aggregate: 2.66
4. Specific Gravity of Fine aggregate: 2.60
5. Coarse aggregate: Conforming to Table 2 of IS 383
6. Fine aggregate: Conforming to Zone II of IS 383

VI. EXPERIMENTAL PROGRAMME

6.1 INTRODUCTION

In this chapter, concepts of experimental work are presented. Objective of testing, i.e. ordinary Portland cement, fine aggregate, natural coarse aggregate, potable water, recycled coarse aggregate, process of manufacturing of concrete, workability of fresh concrete and testing of hardened concrete procedures are explained in details.

6.2 PROCESS OF MANUFACTURING OF CONCRETE

6.2.1 Aggregates:

For water absorption test the coarse aggregate was kept completely immersed in clean water for 24 hours. After this period, the aggregate was surface dried. To be completely surface dry it was then spread out and exposed to the atmosphere until it appears.

6.2.2 Batching:

Batching means measuring the quantities of constituents of concrete required for the preparation of concrete mix. Weight batch method is adopted to measure the quantities. The quantities of fine aggregate, Natural coarse aggregate, Polypropylene fiber, cement, water for each batch were measured by a weighing balance according to the mix proportions obtained by the mix design.

6.2.3 Mixing:

The process of coating all the aggregate particles with Cement paste and to blend all the ingredients of concrete into a uniform mass is known as mixing. The mixing should ensure that the mass becomes homogeneous, uniform in color and consistency. In this study the process of hand mixing was adopted.

Mixing of Concrete

6.3 TESTS ON FRESH CONCRETE

6.3.1 Slump cone test:

This test is performed to check the consistency of fresh concrete. It is used to indicate the degree of wetness. The test is performed on a slump cone. The internal surface of the mould is cleaned thoroughly and filled with concrete in four layers. Each layer is compacted 25 times with a tamping rod.

Slump Cone Test

6.3.2 Compaction factor test:

There is no generally accepted method of directly measuring the amount of work necessary to achieve full compaction, which is a definition of workability. Probably the best test yet available uses the inverse approach: the degree of compaction achieved by a standard amount of work is determined. The work applied includes perforce the work done against the surface friction but this is reduced to a

minimum, although probably the actual friction varies with the workability of the mix.

6.4 TESTS ON HARDENED CONCRETE

6.4.1 Compressive strength test:

Compression test is the most common test conducted on hardened concrete, partly because it is an easy test to perform, and partly because most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength.

Specimen under Compressive testing Machine

6.4.2 Split tensile strength test:

The cylinder specimen is of the size 150 mm diameters and 300mm length. The test is carried out by placing a cylindrical specimen horizontally between the loading surfaces of compression testing machine and the load is applied until failure of cylinder, along its longitudinal direction. The cylinder specimens are tested at 28 days. The average of three specimens was reported as the split tensile strength.

Cylinder Specimen

6.4.3 Flexural Strength:

Flexural strength is one measure of the tensile strength of concrete. Flexural MR is about 10- 20% of compressive strength depending on the type, size and volume of coarse aggregate used. The MR determined by third-point loading is lower than the MR determined by centre point loading, sometimes by as much as 15%.

Flexural testing machine

VII.RESULTS AND DISCUSSIONS

7.1 INTRODUCTION

In this chapter, the experimental observations discussed are presented. The test results such as compressive strength, split tensile strength of hardened concrete of M40 grade and M45 grade with addition of Recron 3s fiber of varying percentages i.e. 0%, 0.25%, 0.50%, 0.75% to that of cement weight at the ages of 28 days are detailed.

7.2 Slump cone test and Compaction factor test:

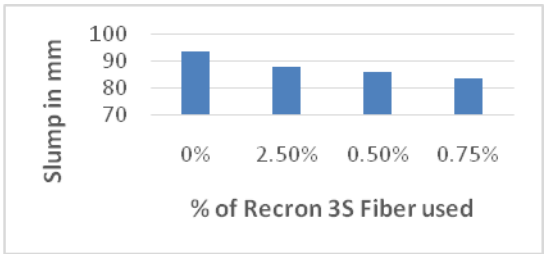
7.2.1 Slump cone test and Compaction factor test Of M40 Mix:

The slump cone test was conducted for all the six mixes. Slumps for different mixes are shown below and Compaction factor test was conducted for all the mixes and the observations are shown below.

Slump cone and compaction factor test results

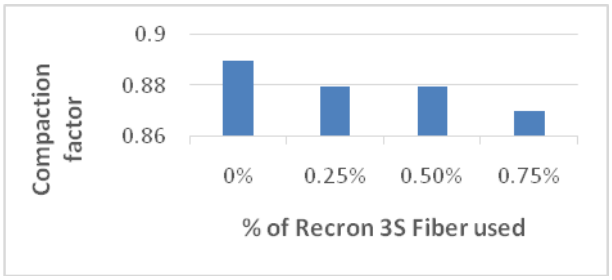
S. No	Mix	Slump (mm)	Compaction factor
1	0%	94	0.89
2	0.25%	88	0.88
3	0. 50%	86	0.88
4	0.75%	84	0.87

Graphical representation of Slump Test



Slump vs. % fiber

Graphical representation of Compaction factor



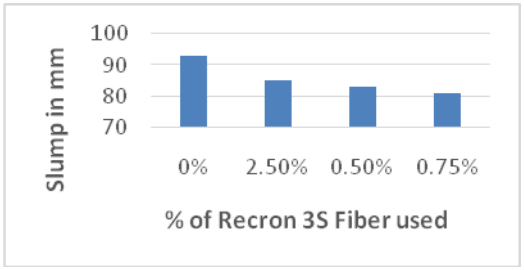
Compaction factor vs. % fiber

7.2.2 SLUMP CONE TEST AND COMPACTION FACTOR TEST FOR M45 MIX

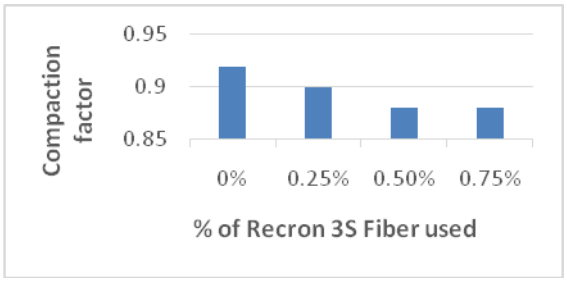
Slump cone and compaction factor test results

S. No	Mix	Slump (mm)	Compaction factor
1	0%	93	0.92
2	0.25%	85	0.90
3	0. 50%	83	0.88
4	0.75%	81	0.88

Graphical representation of Slump Test



Graphical representation of Compaction factor Test



Compaction factor vs. % fiber

7.3 COMPRESSIVE STRENGTH

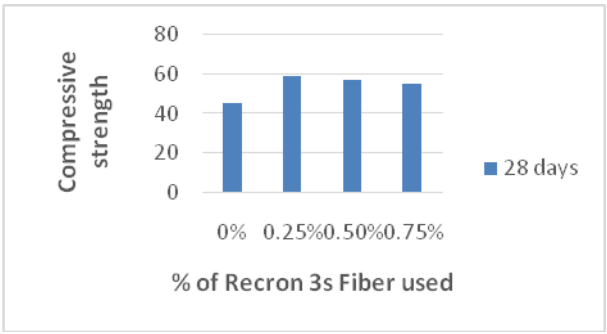
7.3.1 Test Results For M40 mix:

The concrete compressive strength is made in cubes of 150 x 150 x 150mm. A total of 24 cubes were released for the four mixtures. That is, 6 cubes were prepared for each mixture. Samples were tested in 28 days at a rate of three cubes for each mixture on that specific day.

Compressive strength test results

S.NO	% OF RECRON 3S	LOAD(KN)	COMPRESSIVE STRENGTH(N/MM^2)	AVERAGE COMPRESSIVE STRENGTH(N/MM^2)
		28 DAYS	28 DAYS	28 DAYS
1	0%	1010.79	43.90	45.15
		991.67	45.20	
		1065.36	46.35	
2	0.25%	1336.50	58.69	59.26
		1294.02	57.87	
		1374.42	61.23	
3	0.50%	1271.49	55.98	56.86
		1266.21	57.01	
		1294.49	57.61	
4	0.75%	1264.79	55.78	55.32
		1234.99	53.99	
		1240.87	56.21	

Graphical representation of Compressive Strength Values



7.3.2 Result Analysis:

The compressive strength values were obtained by testing standard cubes made with concrete mixes with different percentages addition of Recron 3s fibers.

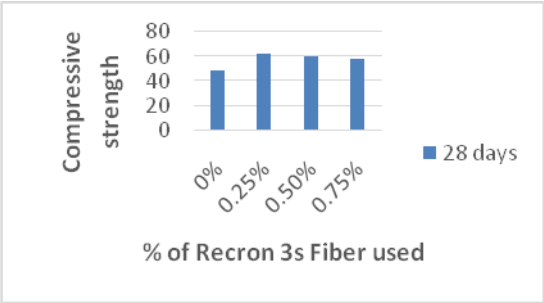
- It was observed that the compressive strength of 0.25%Recron 3s fiber Reinforced concrete at the age of 28 days has increased by 31.25%when compared with Plain cement concrete.
- It was observed that the compressive strength of 0.50%Recron 3s fiber Reinforced concrete at the age of 28 days has increased by 25.93% when compared with PCC.
- It was observed that the compressive strength of 0.75%Recron 3s fiber Reinforced concrete at the age of 28 days has increased by 22.52%when compared with PCC.

7.3.3 Test Results For M45 mix:

Compressive strength test results

S.NO	% OF RECRON 3S	LOAD(KN)	COMPRESSIVE STRENGTH(N/MM^2)	AVERAGE COMPRESSIVE STRENGTH(N/MM^2)
		28 DAYS	28 DAYS	28 DAYS
1	0%	1007.68	48.81	48.38
		973.54	47.23	
		1058.71	49.12	
2	0.25%	1324.41	61.78	62.38
		1278.83	60.13	
		1369.87	65.23	
3	0.50%	1269.23	59.89	59.77
		1258.69	59.12	
		1287.76	60.32	
4	0.75%	1257.93	58.83	58.48
		1227.79	58.25	
		1234.32	58.37	

Graphical representation of Compressive Strength Values



7.3.4 Result Analysis:

- It was observed that the compressive strength of 0.25%Recron 3s fiber Reinforced concrete at the age of 28 days has increased by 28.93%when compared with Plain cement concrete.
- It was observed that the compressive strength of 0.50%Recron 3s fiber Reinforced concrete at the age of 28 days has increased by 23.54% when compared with PCC.

7.4SPLIT TENSILE STRENGTH

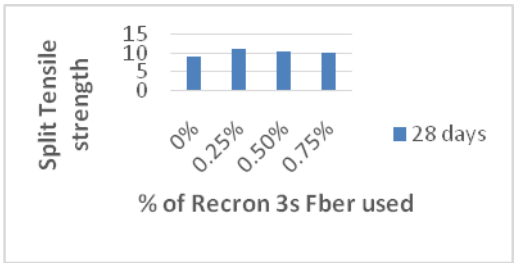
7.4.1 Test Results:

Standard cylinder specimens of length 300 mm and diameter 50 mm were tested for split tensile strength with different percentage of Recron 3s fiber content at 28 days.

Split tensile strength test results

S.NO	MIX	LOAD(KN)	SPLIT TENSILE STRENGTH(N/MM^2)	AVERAGE STRENGTH(N/MM^2)
		28 DAYS	28 DAYS	28 DAYS
1	0% Recron 3s fiber	354.98	4.99	4.43
		265.01	4.10	
		293.96	4.21	
2	0.25% Recron 3s fiber	449.97	6.47	6.36
		432.33	6.12	
		455.69	6.51	
3	0.5% Recron 3s fiber	429.98	6.10	5.89
		399.02	5.59	
		424.22	5.99	
4	0.75% Recron 3s fiber	419.99	5.89	5.69
		394.13	5.69	
		384.89	5.51	

Graphical representation of Split Tensile Strength Values



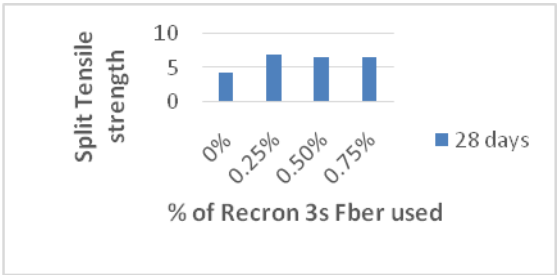
7.4.2 Result analysis

The split tensile strength of Plain Cement Concrete at 28 days was found to be 4.43Mpa. The split tensile strength of 0.50% Recron 3s FRC at 28 days was observed to be increased by only 32.95% when compared to Plain cement concrete.

Split tensile strength test results

S.NO	MIX	LOAD(KN)	SPLIT TENSILE STRENGTH(N/MM^2)	AVERAGE STRENGTH(N/MM^2)
		28 DAYS	28 DAYS	28 DAYS
1	0% Recron 3s fiber	351.99	5.5	4.43
		255.20	4.80	
		300.36	5.20	
2	0.25% Recron 3s fiber	459.12	7.10	7.07
		429.46	6.82	
		468.70	7.30	
3	0.5% Recron 3s fiber	432.67	6.89	6.62
		401.30	6.20	
		430.56	6.78	
4	0.75% Recron 3s fiber	421.88	6.77	6.52
		392.42	6.41	
		386.67	6.38	

Graphical representation of Split tensile Strength Values



Split tensile strength vs. % fiber

7.5 FLEXURAL STRENGTH

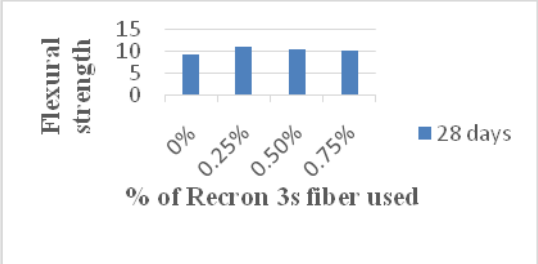
7.5.1 Test Results:

Standard beam specimen size is 700 x 150 x 150mm. Flexural strength was tested with different proportions of the Recron 3 fiber content in 28 days. Three specimens were tested for each fiber content ratio and mean strength was obtained.

Flexural strength test results

S.NO	MIX	LOAD(KN)	FLEXURAL STRENGTH(N/MM^2)	AVERAGE STRENGTH(N/MM^2)
		28 DAYS	28 DAYS	28 DAYS
1	0% Recron 3s fiber	337.97	10.99	9.19
		368.12	11.10	
		397.69	11.33	
2	0.25% Recron 3s fiber	455.13	10.99	11.14
		386.93	11.10	
		347.95	11.33	
3	0.5% Recron 3s fiber	379.01	9.80	10.51
		404.99	10.50	
		441.10	11.22	
4	0.75% Recron 3s fiber	397.12	10.00	10.10
		445.70	10.20	
		297.50	10.10	

Graphical representation of Flexural Strength Values



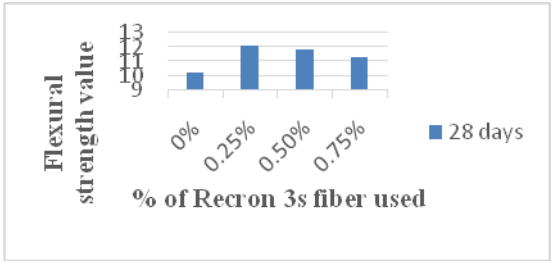
Flexural strength vs. %fiber

7.5.2 Result analysis

Flexural strength test results

S.NO	MIX	LOAD(KN)	FLEXURAL STRENGTH(N/MM^2)	AVERAGE STRENGTH(N/MM^2)
		28 DAYS	28 DAYS	28 DAYS
1	0% Recron 3s fiber	329.86	10.10	10.28
		347.31	10.25	
		376.91	10.49	
2	0.25% Recron 3s fiber	439.29	12.98	12.07
		374.67	11.86	
		326.81	11.39	
3	0.5% Recron 3s fiber	358.53	11.53	11.83
		399.81	11.87	
		437.89	12.11	
4	0.75% Recron 3s fiber	386.24	11.63	11.35
		438.60	12.02	
		289.46	10.41	

Graphical representation of Flexural Strength Values



7.6 COMPARSION OF COST ESTIMATION BETWEEN ORDINARY CONCRETE AND RECRON3S CONCRETE

Estimation results for M40

S.No.	Ordinary Concrete Grade(M_{40})		0.25% Recron 3S concrete Grade(M_{40})	
	Weight (Kg)	Cost (Rs/-)	Weight (Kg)	Cost (Rs/-)
Cement	415	3071	411.5	3045
Fine Aggregate	645	242	645	242
Coarse Aggregate	1160	568	1160	568
Super Plasticizer	2.075	320	2.075	320
Recron 3S	-	-	1.037	390
Total		4201		4565

Estimation results for M40

S.No.	Ordinary Concrete Grade(M_{45})		0.25% Recron 3S concrete Grade(M_{45})	
	Weight (Kg)	Cost (Rs/-)	Weight (Kg)	Cost (Rs/-)
Cement	400	2960	399	2953
Fine Aggregate	574	216	574	216
Coarse Aggregate	1252	613	1252	613
Super Plasticizer	2	180	2	180
Recron 3S	-	-	1	375
Total		3969		4337

VIII. CONCLUSION

8.1 GENERAL

All experimental data show that Recron 3s reinforced concrete is much better in physical and mechanical properties than normal concrete.

Based on the results and discussions, the following conclusions can be drawn:-

1. For all Recron 3s fiber proportions i.e.0.25%,0.5% and 0.75% the compressive strength of concrete is increased when compared with compressive strength of plain cement concrete. But the maximum compressive strength of Recron 3s fiber reinforced concrete is obtained when the fiber content is 0.25% at 28 days of curing for both M40 and M45.
2. For all Recron 3s fiber proportions i.e.0.25%,0.5% and 0.75% the split tensile strength of concrete is increased when compared with Split tensile strength of plain cement concrete. But the maximum split tensile strength of Recron 3s fiber reinforced concrete is obtained when the fiber content is 0.25% at 28 days of curing for both M40 and M45.
3. For all Recron 3s fiber proportions i.e.0.25%,0.5% and 0.75% the flexural strength of concrete is increased when compared with flexural strength of plain cement concrete. But the maximum flexural strength of Recron 3s fiber reinforced concrete is obtained when the fiber content is 0.25% at 28 days of curing for both M40 and M45.
4. No dramatic changes were observed in the physical properties of concrete even though Recron 3S fibers were added.
5. For better performance, it is suggestible to adopt 0.25% of recron 3s rather than ordinary concrete based on estimation considered.
6. From the overall study, it can be traced that adding

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