EXPERIMENTAL INVESTIGATION ON THE PROPERTIES OF PLASTIC FIBRE REINFORCED CONCRETE ON DIFFERENT ASPECT RATIOS

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Abstract— **There is a growing awareness of the advantages of plastic fibre reinforcement techniques of construction all over the world. In the recent times, there is a growing intrust on the use of various type of fibres in structural applications due to their light weight, low cost and sustainability. This project presents a brief state-of-the-art report on durability of Plastic fibre reinforced concrete. In particular project related to fibre reinforcement mechanism. Standardized testing, resistance to dynamic loads, are discussed. The effect of fibres on the behaviour of plastic and hardened concrete varies depending on the concrete materials Mix proportions, Fibre type and length and quality of fibre added. Experimental and analysis of result were conducted to study the compressive & tensile behavior of composite concrete with varying percentage of such fibres added to it. The grade concrete, M20 is adopted with varying percentage of fibres ranging from 0.5%, 1% & 1.5% on different characteristic type of fibre Experimental and analysis of result on standard size of beam (50x10x10cm), cube (15x15x15cm) and size of cylinder 15 cm diameter and 30cm long are adopted for testing. Size of This material can help us to develop intelligent infrastructure with elegantly integrated sensing.**

Key Words— **Concrete, Plastic fiber, Compressive Strength, Split Tensile Strength and Flexural strength.**

I. INTRODUCTION

Concrete is one of the most versatile building materials. It can be cast to fit any structural shape from a cylindrical water storage tank to a rectangular beam or column in a high rise building. The advantage of using concrete include high compressive strength, good fire resistance, high water resistance, low maintenance and long service life. The disadvantage of using concrete include poor tensile strength, low strain of fracture and formwork requirement. The major disadvantage is that concrete develops micro cracks during curing. It is a rapid propagation of these micro cracks under applied stress that is responsible for the low tensile strength of the material. Hence fibre are added to concrete to overcome these disadvantages.

II. LITERATURE REVIEW

"Studies on Fibre Reinforced Concrete IJSRD -Vol. 4- Issue july,2016" Rachit Silawat1 Anil Kumar, UG Student, Team Leader, Department of Civil Engineering, Laxmi Narain College of Technology & Science Highway Engineering Consultant, Fibres are generally used as resistance of cracking and strengthening of concrete. In this project, I am going to carry out test on steel fibre reinforced concrete to check the influence of fibres on flexural strength of concrete. Concrete possesses a very low tensile strength, limited ductility and little resistance to cracking.

III. TEST TECHNIQUE

A. *Compressive Strength*

After the required period of curing, the cubes were taken out and allowed to dry for about four hours Then the cubes were kept in the uniaxial compression testing machine (UTM) of capacity 2000 KN. Before starting the test, the machine was completely checked and proper working was ensured. At the time of breaking, the cube failure load was noted and the average compressive strength was calculated.

Ultimate compressive strength = (ultimate compressive load (Pu)/ area of the specimen (A))

B. *Split Tensile Strength*

This is also referred as "Brazilian test "this test was developed in brazil in 1943. At about the same time, this was also independently developed in japan. The test is carried out by placing a cylinder specimen horizontally between the loading surface of a compression testing machine and the load is applied until failure of the cylinder, along the vertical diameter.

THEORY

UCS=PU/A

Where;

UCS =ultimate compressive strength,

PU =ultimate compressive load

A =Area of specimen

IV. TEST RESULT

A. *Test Result for Conventional Concrete*

TABLE IV: I: COMPRESSIVE STRENGTH OF CONVENTIONAL CONCRETE

Sl.No	Name of the specimen	Ultimate compressive strength in N/mm^2		
		7days	14days	28days
1	CUBE	18.26	19.55	21.33
2	CUBE	17.30	18.66	22.22
3	CUBE	16.00	17.77	20.88
	AVERAGE	17.18	18.99	21.47

TABLE IV: II: SPLIT TENSILE STRENGTH OF CONVENTIONAL CONCRETE

Sl.NO	Name of the specimen	Ultimate split tensile strength in N/mm^2		
		7days	14days	28days
1	CYLINDER	1.55	1.83	2.26
2	CYLINDER	1.83	2.12	2.40
3	CYLINDER	1.69	1.98	2.26
	AVERAGE	1.69	1.97	2.30

TABLE IV: III: FLEXURAL STRENGTH OF CONVENTIONAL CONCRETE

Sl.No	Name of the specimen	Ultimate flexural strength in N/mm^2		
		7days	14days	28days
1	BEAM	5.50	6.75	8.25
2	BEAM	5.25	6.00	8.00
3	BEAM	4.75	5.50	7.50
	AVERAGE	5.16	6.08	7.91

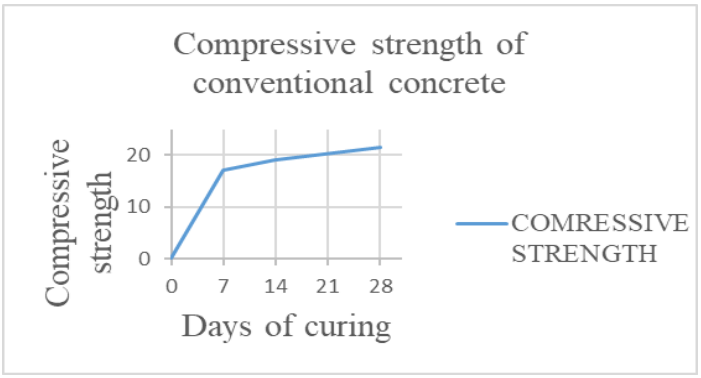

Fig. 1. Compressive Strength of Conventional Concrete

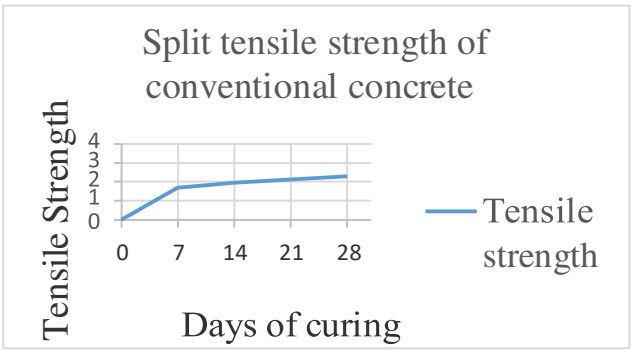

Fig. 2. Split Tensile Strength of Conventional Concrete

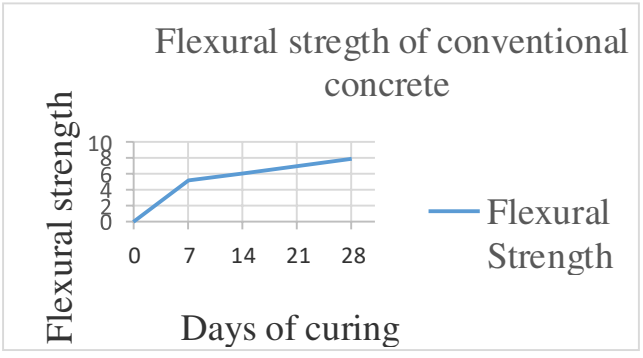

Fig. 3. Flexural Strength of Conventional Concrete

B. Test Result for Plaster Reinforced Fibre Concrete

1) Compression Test for Cubes

Size of the specimen = 150mmx150mmx150mm

Area of the specimen = 22500mm^2

TABLE IV: IV: COMPRESSIVE STRENGTH OF 0.5% PR FIBRE ADDED CONCRETE

Sl. No	Name of the specimen	Ultimate compressive strength in N/mm^2		
		7days	14days	28days
1	CUBE (0.5%)	31.5	36.88	40.88
2	CUBE (0.5%)	32.44	37.77	42.22
3	CUBE (0.5%)	32.88	36.88	43.55
	AVERAGE	32.27	37.17	42.21

TABLE IV: V: COMPRESSIVE STRENGTH OF 1% PR FIBRE ADDED CONCRETE

Sl. No	Name of the specimen	Ultimate compressive strength in N/mm^2		
		7days	14days	28days
1	CUBE (1%)	35.55	46.22	57.77
2	CUBE (1%)	36.44	44.44	51.11
3	CUBE (1%)	37.77	45.33	53.33
	AVG	36.58	45.33	54.07

TABLE IV: VI: COMPRESSIVE STRENGTH OF 1.5% PR FIBRE ADDED CONCRETE

Sl. No	Name of the specimen	Ultimate compressive strength in N/mm^2		
		7days	14days	28days
1	CUBE (1.5%)	32.40	43.55	53.33
2	CUBE (1.5%)	33.77	42.66	48.00
3	CUBE (1.5%)	32.88	41.33	46.22
	AVERAGE	33.01	42.51	49.18

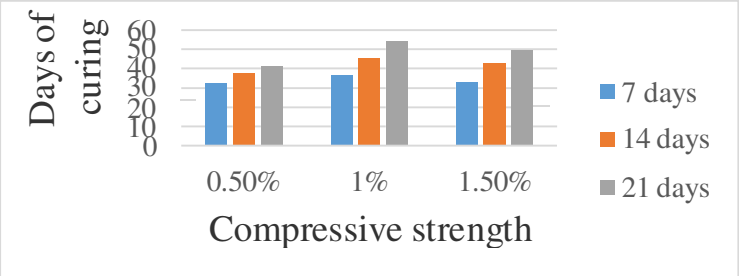

Fig. 4. Compressive Strength of PR Concrete

Hence it has more compressive strength with the addition of 1% plaster reinforced fibre in to the concrete.

2) Split Tensile Strength for Cylinder

Size of the specimen = 150mm diameter and 300mm long

TABLE IV: VII: SPLIT TENSILE STRENGTH OF .5% PR FIBRE ADDED CONCRETE

Sl. No	Name of the specimen	Ultimate split tensile strength in N/mm^2		
		7days	14days	28days
1	CYLINDER (0.5%)	2.26	2.23	2.40
2	CYLINDER (0.5%)	2.12	2.26	2.54
3	CYLINDER (0.5%)	1.98	2.40	2.40
	AVERAGE	2.12	2.33	2.44

TABLE IV: VII: SPLIT TENSILE STRENGTH OF 1% PR FIBRE ADDED CONCRETE

Sl. No	Name of the specimen	Ultimate split tensile strength in N/mm^2		
		7days	14days	28days
1	CYLINDER (1%)	2.54	2.68	3.40
2	CYLINDER (1%)	2.68	3.12	2.97
3	CYLINDER (1%)	2.54	2.82	3.25
	AVERAGE	2.58	2.87	3.20

TABLE IV: VII: SPLIT TENSILE STRENGTH OF 1.5% PR FIBRE ADDED CONCRETE

Sl.No	Name of the specimen	Ultimate split tensile strength in N/mm^2		
		7days	14days	28days
1	CYLINDER (1.5%)	1.98	2.54	2.68
2	CYLINDER (1.5%)	2.40	3.68	2.82
3	CYLINDER (1.5%)	2.26	2.54	2.97
	AVERAGE	2.21	2.58	2.82

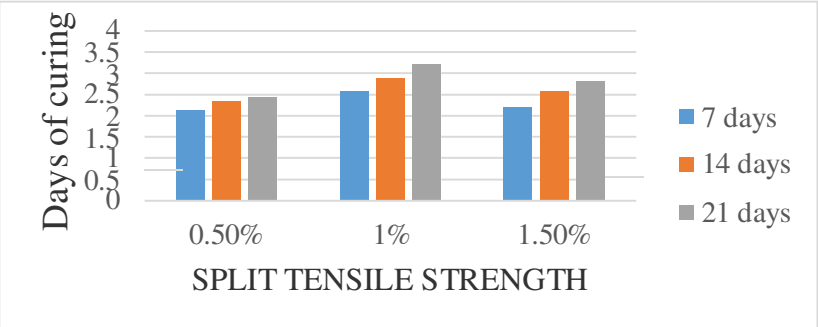

Fig. 5. Split tensile Strength of PR Concrete

Hence it has more split tensile strength with the addition of 1% plaster reinforced fibre added into the concrete.

3) Flexural Strength of 28 Days Curing

TABLE IV: VIII: FLEXURAL STRENGTH OF 0.5% PR FIBRE ADDED CONCRETE

Sl.No	Name of the specimen	Ultimate flexural strength in N/mm^2		
		7days	14days	28days
1	BEAM (0.5%)	7.75	9.25	11.75
2	BEAM (0.5%)	8.25	8.75	11.00
3	BEAM (0.5%)	8.00	8.25	10.00
	AVERAGE	8.00	8.33	10.91

TABLE IV: IX: FLEXURAL STRENGTH OF 1% PR FIBRE ADDED CONCRETE

Sl.No	Name of the specimen	Ultimate flexural strength in N/mm^2		
		7days	14days	28days
1	BEAM (1%)	8.25	9.25	14.25
2	BEAM (1%)	8.75	8.75	13.25
3	BEAM (1%)	9.00	9.00	12.25
	AVERAGE	8.66	9.00	13.25

TABLE IV: IX: FLEXURAL STRENGTH OF 1% PR FIBRE ADDED CONCRETE

Sl.No	Name of the specimen	Ultimate flexural strength in N/mm^2		
		7days	14days	28days
1	BEAM (1.5%)	8.00	9.25	12.75
2	BEAM (1.5%)	8.25	8.75	11.75
3	BEAM (1.5%)	8.00	9.00	11.25
	AVERAGE	8.08	8.41	11.91

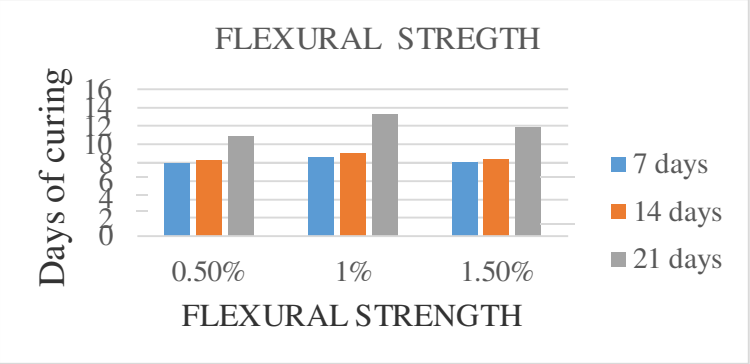

Fig. 6. Flexural Strength of PR Concrete

Hence it has more split tensile strength with the addition of 1% plaster reinforced fibre added into the concrete.

4) Comparison Between Conventional Concrete and Plaster Reinforced Concrete

a) 0.5% PR Concrete and Conventional Concrete

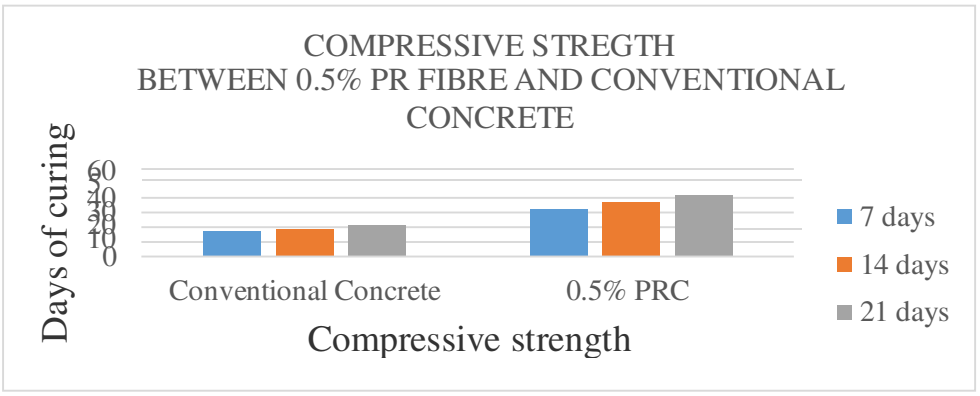

Fig 7. Compressive Strength Between 0.5% PR Fibre and Conventional concrete

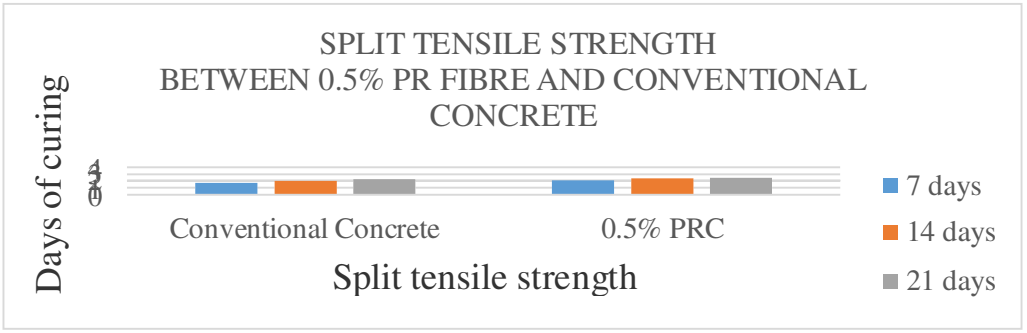

Fig 8. Compressive Strength Between 0.5% PR Fibre and Conventional concrete

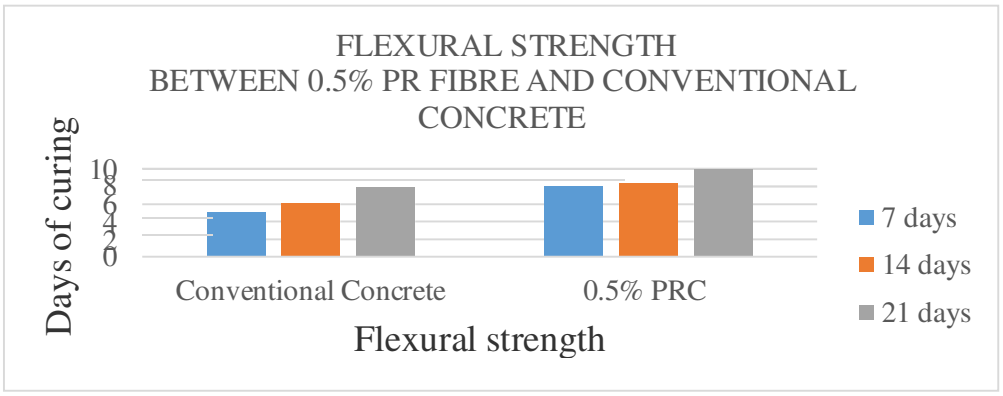

Fig 9. Flexural Strength Between 0.5% PR Fibre and Conventional Concrete

Hence it has more Flexural, split tensile & compressive strength with the addition of 0.5% plaster reinforced fibre added in to the concrete than conventional concrete.

b) 1% PR Concrete and Conventional Concrete

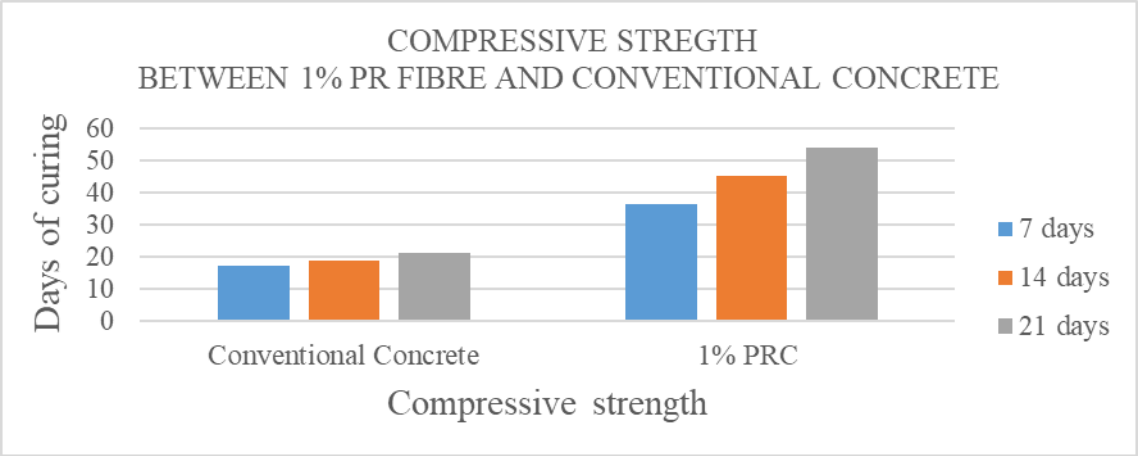

Fig 10. Compressive Strength Between 1% PR Fibre and Conventional concrete

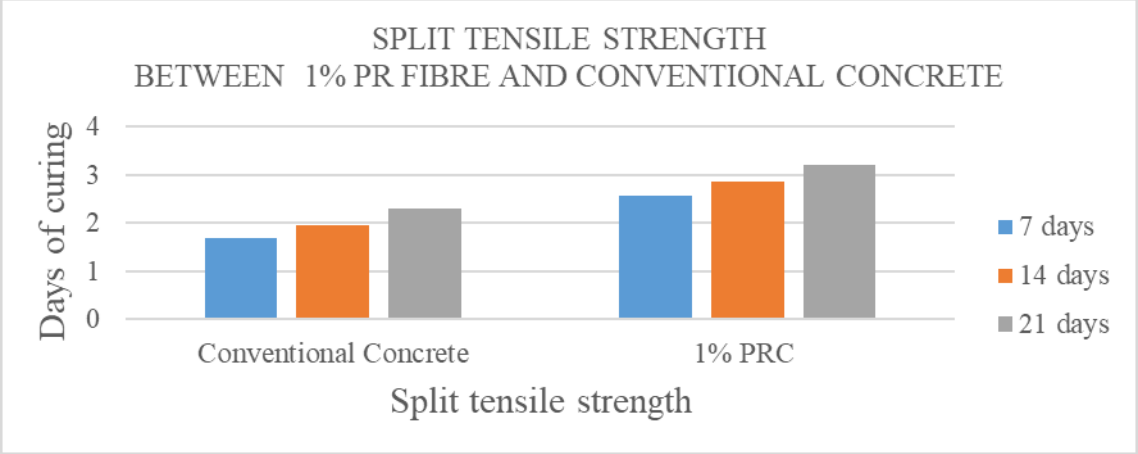

Fig 11. Split tensile Strength Between 1% PR Fibre and Conventional concrete

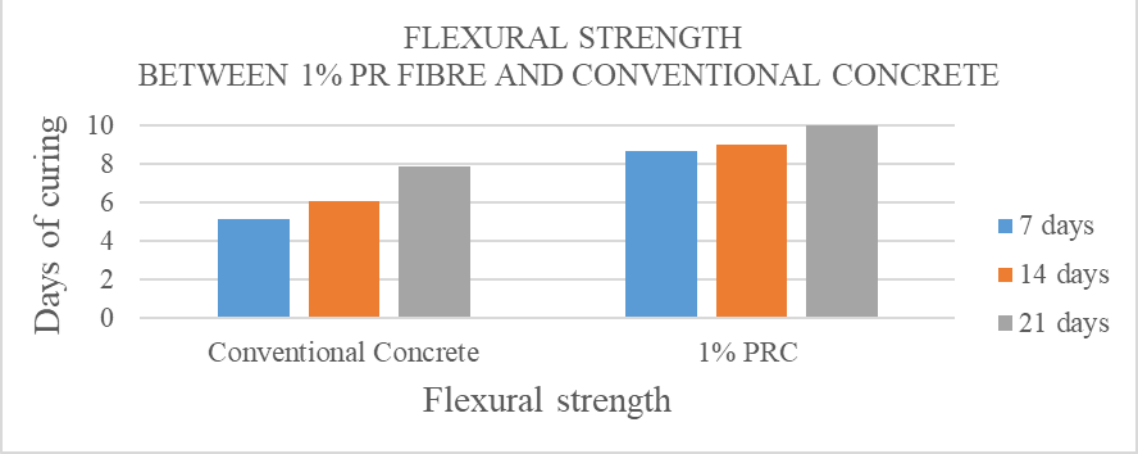

Fig 12. Flexural Strength Between 1% PR Fibre and Conventional concrete

Hence it has more Flexural, split tensile & compressive strength with the addition of 1% plaster reinforced fibre added in to the concrete than conventional concrete.

c) 1% PR Concrete and Conventional Concrete

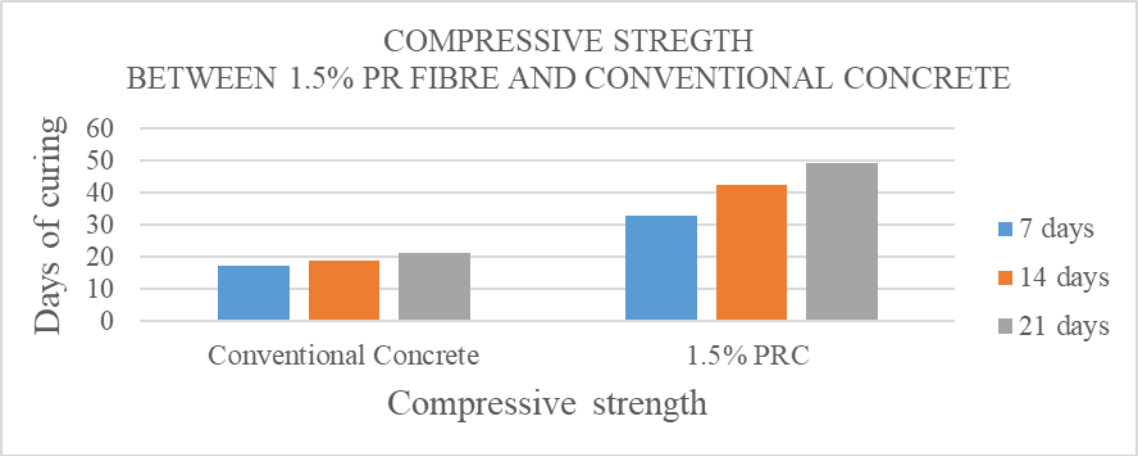

Fig 13. Compressive Strength Between 1.5% PR Fibre and Conventional concrete

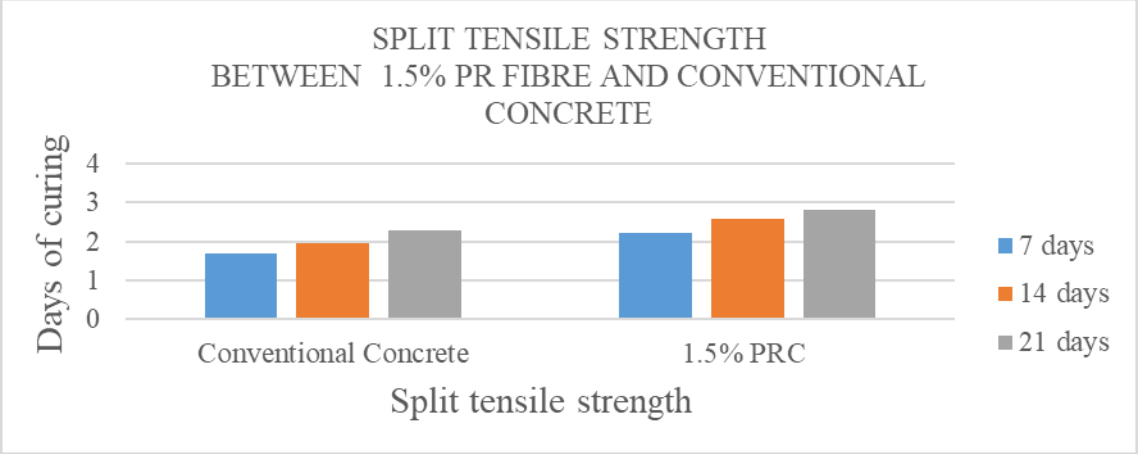

Fig 14. Split tensile Strength Between 1.5% PR Fibre and Conventional concrete

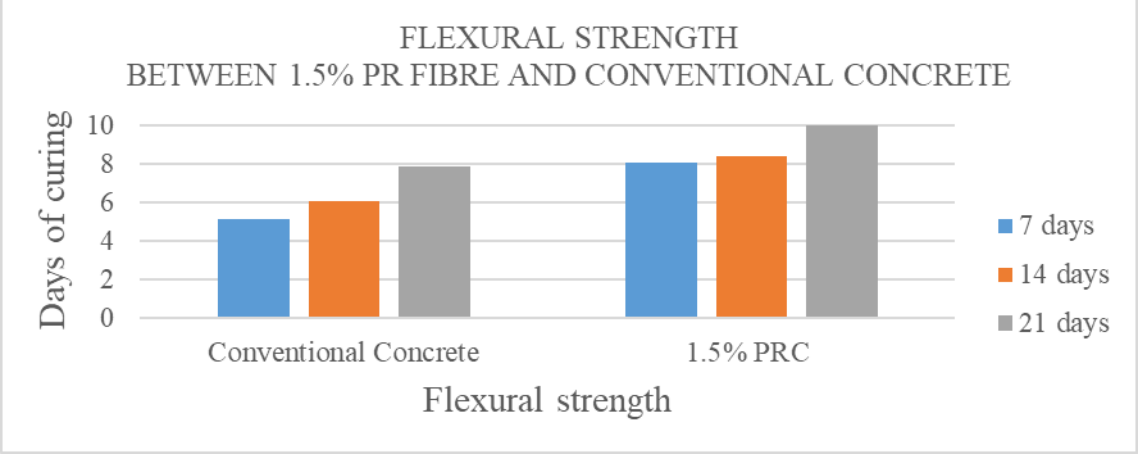

Fig 15. Flexural Strength Between 1.5% PR Fibre and Conventional concrete

Hence it has more Flexural, split tensile & compressive strength with the addition of 1% plaster reinforced fibre added in to the concrete than conventional concrete.

d) Comparison of compressive, split tensile & flexural strength with conventional concrete

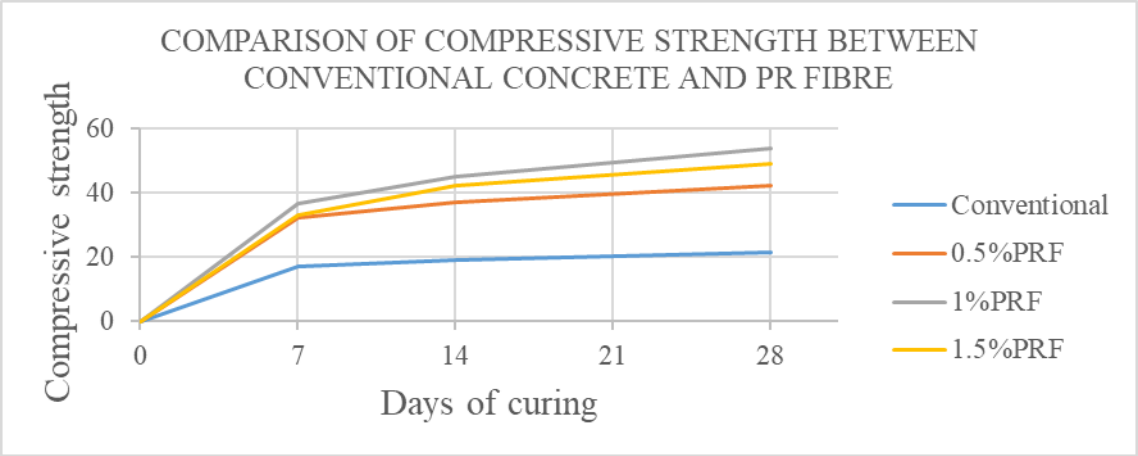

Fig 16. Comparison of Compressive Strength Between Conventional Concrete and PR Fibre

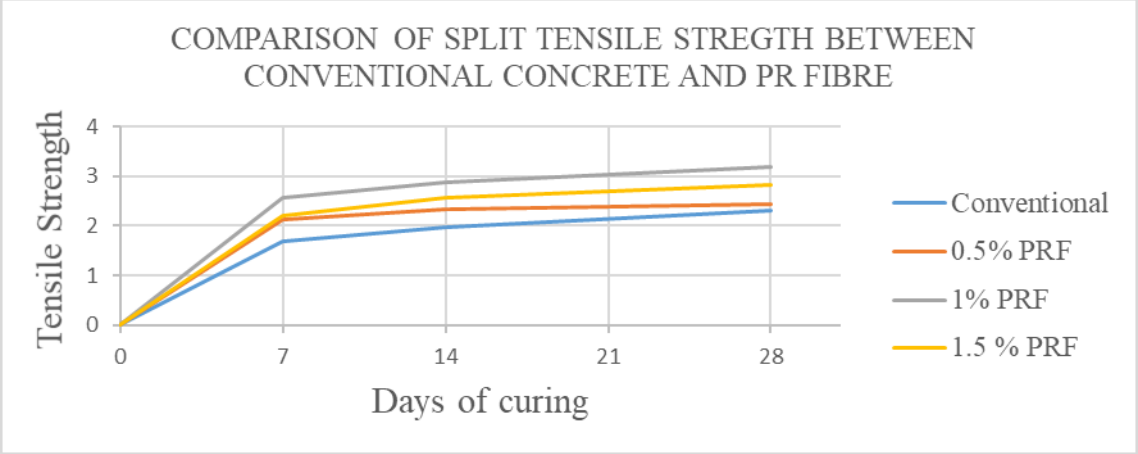

Fig 17. Comparisons of Split Tensile Strength Between Conventional Concrete and PR Fibre

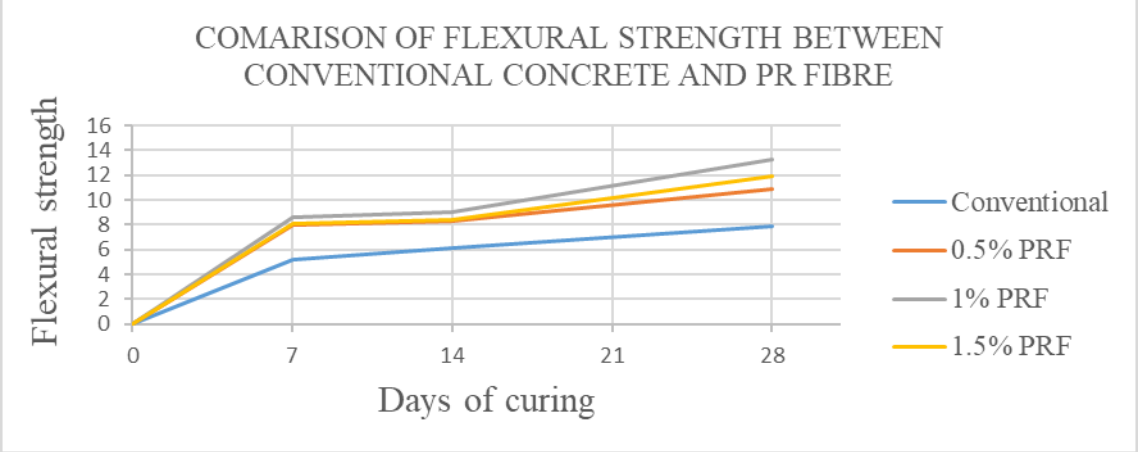

Fig 18. Comparison of Flexural Strength Between Conventional Concrete and PR Fibre

Hence it has more flexural strength with the addition of 1% plaster reinforced fibre added in to the concrete than conventional concrete

V. COST ANALYSIS

A. Price Detail of Materials

TABLE V: I PRICE DETAIL OF MATERIALS

Sl.No	MATERIALS	UNIT (Kg)	RATE (RS)
1	CEMENT	1	7.00
2	SAND	1	1.00
3	COARSE AGGREGATE	1	0.65
4	PR FIBRE	1	720

B. Cost for Conventional Concrete

TABLE V: II COST FOR 1m3 OF CONVENTIONAL CONCRETE

Sl.No	MATERIALS	UNIT (Kg)	RATE (RS)	AMOUNT (RS)
1	CEMENT	437.7	7.00	3,063.9
2	SAND	679.8	1.2	815.76
3	COARSE AGGREGATE	1164.68	0.8	931.744
	TOTAL AMOUNT			4,811.404

C. Cost for PR Fibre Concrete

TABLE V: III COST FOR 1m3 OF CONVENTIONAL CONCRETE WITH 0.5% PRF

Sl.No	MATERIALS	UNIT (Kg)	RATE (RS)	AMOUNT (RS)
1	CEMENT	437.7	7.00	3,063.9
2	SAND	679.8	1.2	815.76
3	COARSE AGGREGATE	1164.68	0.8	931.744
4	PR FIBRE	2.18	720	1,569.6
	TOTAL AMOUNT			6,381.004

TABLE V: IV COST FOR 1m3 OF CONVENTIONAL CONCRETE WITH 1% PRF

Sl.No	MATERIALS	UNIT (Kg)	RATE (RS)	AMOUNT (RS)
1	CEMENT	437.7	7.00	3,063.9
2	SAND	679.8	1.2	815.76
3	COARSE AGGREGATE	1164.68	0.8	931.744
4	PR FIBRE	4.37	720	3,146.4
	TOTAL AMOUNT			7,957.804

TABLE V: V COST FOR 1m^3 OF CONVENTIONAL CONCRETE WITH 1.5% PRF

Sl.No	MATERIALS	UNIT (Kg)	RATE (RS)	AMOUNT (RS)
1	CEMENT	437.7	7.00	3,063.9
2	SAND	679.8	1.2	815.76
3	COARSE AGGREGATE	1164.68	0.8	931.744
4	PR FIBRE	6.56	720	4,723.2
	TOTAL AMOUNT			9,534.604

D. Cost Analysis between conventional concrete and PR fibre

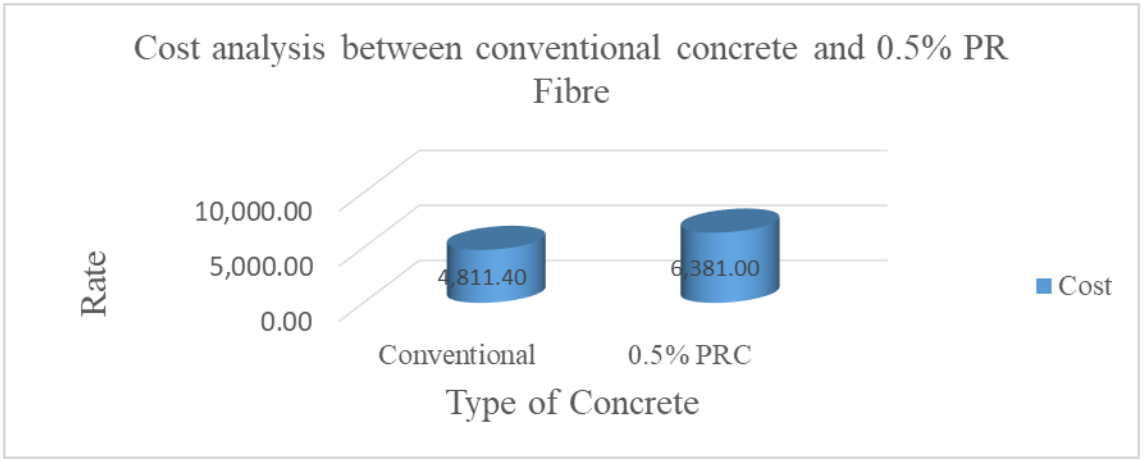

Fig 19. Cost Analysis Between Conventional Concrete and 0.5% PR Fibre

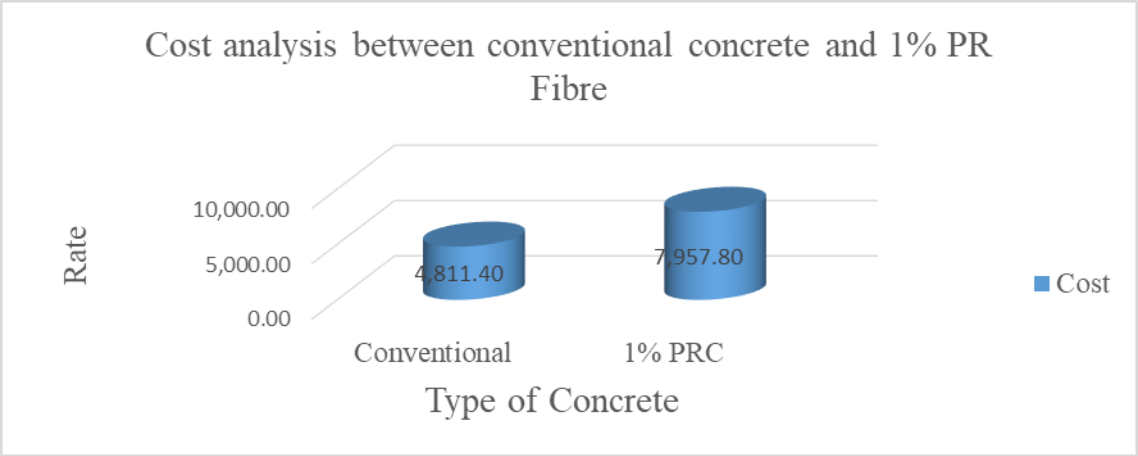

Fig 20 Cost Analysis Between Conventional Concrete and 1% PR Fibre

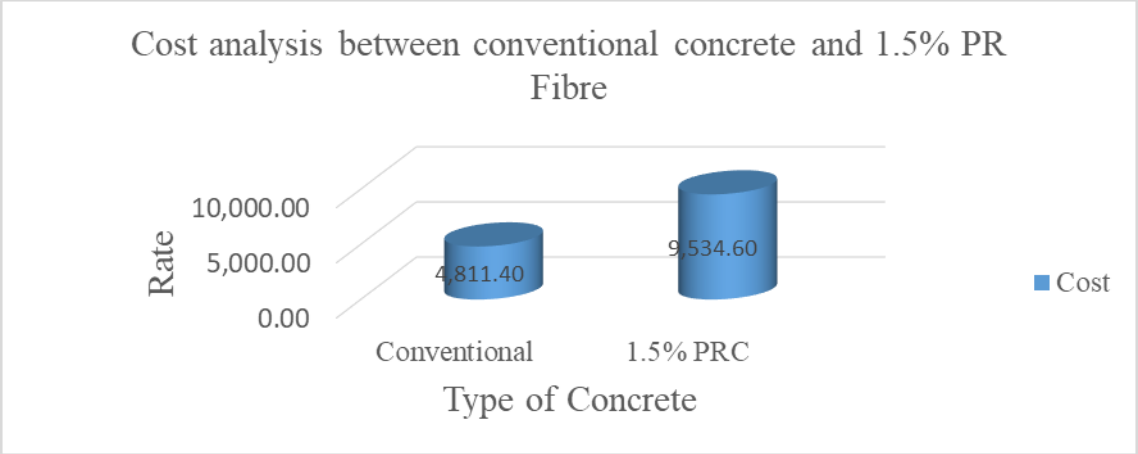

Fig 21. Cost Analysis Between Conventional Concrete and 1.5% PR Fibre

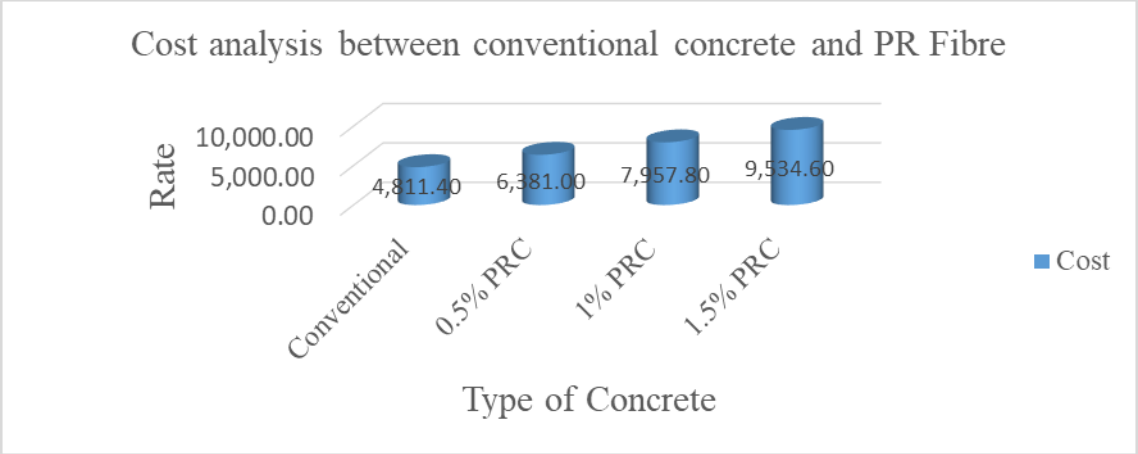

Fig 22. Cost Analysis Between Convention Concrete and PR Fibre

Hence it has more cost with the addition of 1.5% plaster reinforced fibre concrete than conventional concrete.

VI. CONCLUSION

- The addition of the PR fibre at low values actually increases the 28days compressive, tensile and flexural strength.
- PR fibre added 0.5%, 1%and 1.5% to the concrete. In that while adding 1.5% we got the higher strength.
- There is about 40% increase in compression strength by adding 1% of fibres in concrete.
- There is about 71% increase in tensile strength by adding 1% of fibres in concrete.
- There is about 60% increase in flexural strength by adding 1% of fibres in concrete.
- From the above studies we came to know that this type of concrete is more durable when compare to ordinary concrete in terms of strength aspects.
- The more cost with the addition of 1.5% plaster reinforced fibre concrete than conventional concrete.
- These rates are very much variable from region to region and country to Country.
- The PR fibre is easily available and economical one.

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