An Experimental Investigation on Strength and Ductility Behavior of Waste Plastic Fiber Reinforced Concrete

Dr. Rudraswamy M P[1], Prof. Guansheela P[2], Prof. Mahesh Kumar S[3]
[1]*Dr. Rudraswamy M P, Vivekananda Institute of technology*
[2]*Prof.Gunasheela P, R R Institute of technology*
[3]*Prof.Mahesh Kumar S, The Oxford college of engineering*

Abstract **- Concrete is the main material of construction. It consists of cement, fine aggregate, coarse aggregate and water as main ingredients. Due to development in the countries the consumption of the cement and other building materials is more. Also, the use of unfriendly materials to environment such as Plastic usage is more. As plastics are non-biodegradable common environmental polluting materials. In present study the experimental investigation is carried out on waste plastic fibre reinforced concrete. Where the waste plastic is used as the reinforcement in different percentage (0%, 0.5%, 1%, 1.5%, 2%) and the mechanical properties of the concrete like compressive strength, split tensile, flexural strength and ductility factors are studied. It is found that usage of plastic in the concrete increases the performance of the concrete.**

Index Terms **- Fiber reinforced concrete, waste plastic reinforced concrete, eco-friendly concrete, compressive strength, split tensile strength, flexural strength, ductility factor test.**

I.INTRODUCTION

Concrete is defined as a mixture of cement, fine aggregates, course aggregates and water which dries hard and strong and is used as a material for building. Concrete, usually Portland cement concrete is a composite material composed of fine and coarse aggregate bonded together with a fluid cement that hardens over time most frequently in the past a lime-based cement binder, such as lime putty, but sometimes with other hydraulic cements, such as a calcium aluminate cement or Portland cement. It is distinguished from other, non-cementitious types of concrete all binding some form of aggregate together, including asphalt concrete with a bitumen binder, which is frequently used for road surfaces, and polymer concretes that use polymers as a binder.

In the persisting world concrete is widely used in various constructions as it provides the best strength throughout the lifespan of the structure. The concrete is a composite material which is strong in compression but weak in tension. To overcome the weakness of the tensional property of the concrete various composite materials are included in the mix. In such case, waste plastic fibres are used along with the basic mix of the concrete such as cement, sand and coarse aggregates. Hence, it is typically recognized as 'waste plastic fiber Reinforced Concrete'.

II. OBJECTIVES

The main objective of this proposed project work is to study the ductility characteristics of Waste plastic Fiber Reinforced Concrete. Produced by using Waste plastic Fiber and aspect ratio 40 with different percentages like 0%, 0.5%, 1%, 1.5% and 2% by volume fraction addition along with the addition of super plasticizer. To achieve the above objective the following experimental works are planned i.e.

- To find out the strength characteristics of waste plastic Fiber Reinforced Concrete.
- To find out the ductility factor on waste plastic Fiber Reinforced Concrete.

III. MIX DESIGN

M 30 was designed using IS method of mix design. The mix proportion for M 30 grade concrete is given in the following.

Grade of concrete	Cement	Fine aggregate	Coarse aggregate	W/C
M 30	1.00	1.56	2.70	0.45

IV. TESTS CONDUCTED

Following are different types of strength tests conducted on design mix.

- Compressive strength test
- Tensile strength test
- Flexural strength test
- Ductile behavior of waste plastic fiber reinforced concrete

V. EXPERIMENTAL RESULTS

A. Compressive strength

Table 1: Compressive strength values in different percentage of WPF

SL NO	% OF WPF	Compressive strength (N/mm^2)
1	0	32.88
2	0.5	33.92
3	1	34.51
4	1.5	35.11
5	2	34.37

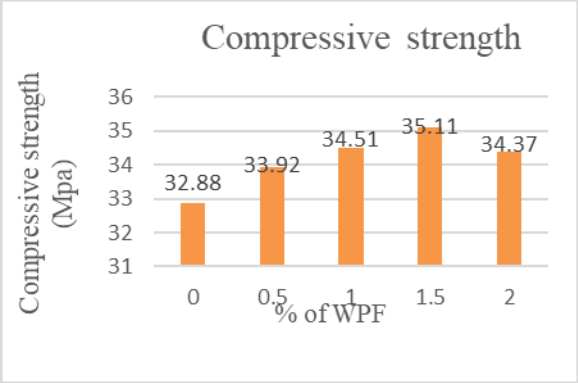

Fig 1: Variation in Compressive strength of the concrete

B. Split tensile strength

Table 2: Split tensile strength values in different percentage of WPF

SL NO	% OF WPF	Split tensile strength (N/mm^2)
1	0	3.11
2	0.5	3.30
3	1	3.44
4	1.5	3.58
5	2	3.39

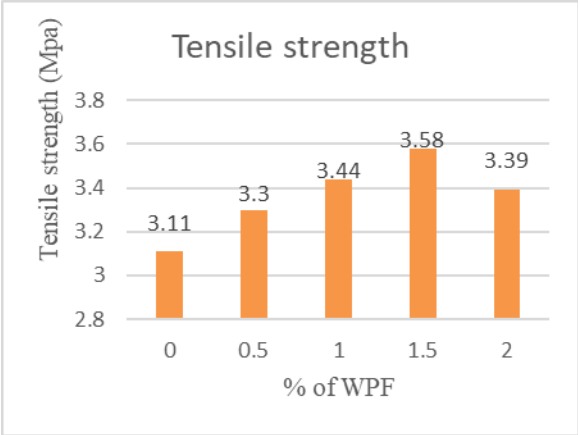

Fig 2: Variation in Split tensile strength of the concrete

C. Flexural strength

Table 3: Flexural strength values in different percentage of WPF

SL NO	% OF WPF	Flexural strength (N/mm^2)
1	0	6.24
2	0.5	6.58
3	1	6.90
4	1.5	7.20
5	2	6.78

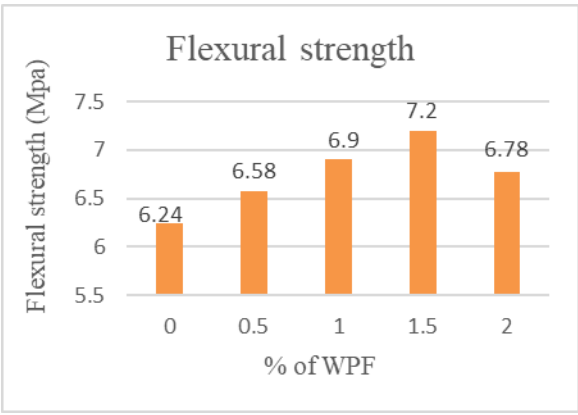

Fig 3: Variation in Flexural strength of the concrete

D. Ductility factor test

Table 4: Ductility factor test values in different percentage of WPF

SL NO	% OF WPF	DF $\mu = \Delta U / \Delta Y$
1	0	0
2	0.5	1.08
3	1	1.77
4	1.5	1.93
5	2	1.67

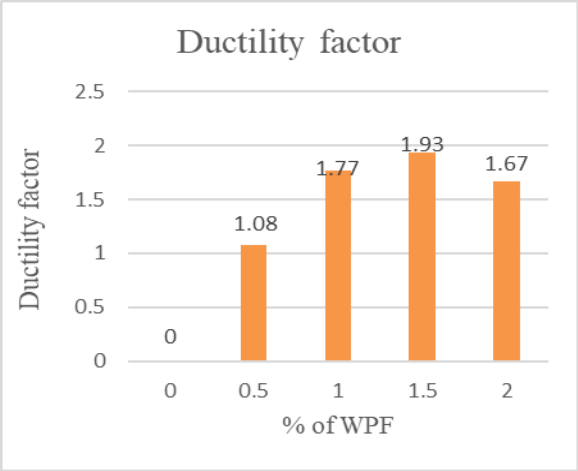

Fig 4: Variation in Ductility factor of the concrete

VII. CONCLUSION

1. Concrete produced by adding of 1.5% of waste plastic fiber reinforcement imparts higher compressive, flexural and split tensile strengths due to sharp edges and better interlocking of sand particles and good bonding with other materials.
2. The compressive strength with 1.5% of plastic fibers is 6.78% more than reference mix (0% replaced mix).
3. The split tensile strength with 1.5% of plastic fibers is 15.11% more than reference mix (0% replaced mix)
4. The flexural strength of 1.5% of plastic fibers is 15.38% more than reference mix (0% replaced mix)
5. Ductility factor test also shows the optimum result for 1.5% plastic usage.
6. The results of this experimental work establishes that plastic fibers will increase the mechanical strength of the concrete. So waste plastic can be used as fiber reinforcement in the construction.

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