CONCRETE CHARACTER ANALYSIS FOR FRESH CONCRETE AND HYBRID FIBER REINFORCED CONCRETE

Vadivel Murugesan[a], Dr.J.Brema[b]

[a]*Research Scholar, Department of Civil Engineering, Karunya Institute of Technology and Sciences, Coimbatore*
[b]*Professor, Department of Civil Engineering, Karunya Institute of Technology and Sciences, Coimbatore*
[a]*vadivelnitcbe@gmail.com*, [b]*bjayanarayanan@gmail.com*

ABSTRACT

"One of the unique and exclusive display concretes is concrete with various little irregular independent low as well as high modulus fibers. As a result of such significant developments, fiber-designed concrete is now widely used in a variety of framework applications. In this beta assessment, the crossover fiber supported cement is encouraged by the usage of low modulus and high modulus filaments. Plastic fiber made from recycled polythene terephthalate is considered to have an erratic modulus whereas steel fiber is considered to have a high modulus. A total of 10 mixtures, along with antiquated cement, were tested. Mono fiber mixes were created using strands of steel, polypropylene, and recycled polythene terephthalate with a 0.5% volume fraction. Six crossover fibers, including steel fiber and recycled polythene terephthalate fiber with three distinct volume sections and steel fiber and polypropylene fiber with three different volume divisions, were used and studied. The combination of 0.25% volume fraction polypropylene fiber and 0.25% volume fraction steel fiber performs better than wholly other blends.

Keywords: *Flexural Behaviour, Fiber Reinforced Concrete, Hybrid Fiber, Recycled Polypropylene Terephthalate*

INTRODUCTION

Concrete is probably a standardised substance made of basic elements like concrete, sand, and coarse aggregate, as well as mineral admixtures like fly ash, floor ash, oxide rage, quartz powder, and once forward, which are small devices for concrete in the large, and additionally chemical admixtures, which are also similarly secured the large to endeavour and created it as a necessary one (1, 2). In order to increase the more efficient use of cement in exact examination works that will keep you fragile in concrete for years on end, it is crucial to continue the investigation strands and invite the local community to the changed (3-6). Fiber Reinforced Concrete (FRC) increases cement strain while also designing the machine's workspace (7-11). Further research has been conducted in the field of FRC using low modulus strands such as polypropylene fiber, polyvinyl liquor fiber, planned tar fiber, and so on, as well as irrational modulus fiber such as antimonial fiber, fiber, carbon fiber, and so on. Selling and organising is often quite tough when it comes to counterfeit pitch terephthalate waste containers that have a negative influence on the global health. In light of this, the anticipated gum terephthalate waste scope is converted to filaments and this check may be wrapped indistinguishably. At some point during this investigation, the mechanical characteristics and flexural conduct of hybrid fiber reinforced concrete (HYFRC), which is composed of metal fiber, plastic fiber, and recycled planned gum terephthalate fiber, were taken into account.

1. MATERIALS USED

In this analysis, concrete, M-sand, coarse aggregate, and water were the materials employed. Concrete used in several of the transactions is standard Portland concrete (OPC). M Sand and Coarse says that strategy for nearest Quarry is beneficial and monstrous. Strands used in this project include recycled synthetic tar terephthalate fiber, plastic fiber (PP), and rectangular live metallic fiber (RPET). These three strands were hybridised in excellent mixes, according to this evaluation. Table 1 shows the mixture of the beneficial in with unusual fiber enfranchisement.

Table 1. Mix ratio's of FRC& HyFRCB beams

Mix	Cement kg/m^3	FA kg/m^3	CA kg/m^3	Water kg/m^3	SP kg/m^3	Steel Fiber (%)	PP Fiber (%)	RPET Fiber (%)
CB	395	715.28	1150	158	7.9	-	-	-
FRCB1	395	715.28	1150	158	7.9	0.5	-	-
FRCB2	395	715.28	1150	158	7.9	-	0.5	-
FRCB3	395	715.28	1150	158	7.9	-	-	0.5
HyFRCB1	395	715.28	1150	158	7.9	0.12	0.38	-
HyFRCB2	395	715.28	1150	158	7.9	0.25	0.25	-
HyFRCB3	395	715.28	1150	158	7.9	0.38	0.12	-
HyFRCB4	395	715.28	1150	158	7.9	0.12	-	0.38
HyFRCB5	395	715.28	1150	158	7.9	0.25	-	0.25
HyFRCB6	395	715.28	1150	158	7.9	0.38	-	0.12

1. EXPERIMENTAL WORK

a) Compressive Strength

Evaluation of compression strength is done by using 150*150*150 mm cube.In addition to being arranged with the majority of the compression half trying out a technique to border use the middle issue load, the 3D construction case is predicted. Until the event fails, the weight is typically maintained at the generality. Due to the stress strain, the case is brought under the significant load at that point. Figure 1 shows the example's testing results.

Figure 1. Setup for Compression Test

b) Split Tensile Strength

In accordance with the guarantee above one, the cut-up real property check consists of a diode at the chamber model for lengths of 300mm tall and 500mm wide.The chamber version is set up with a trial-out framework at regular intervals from the pressure, and the load is delivered in this way until the prevalence splits into two.

Figure 2. Setting for a Split Tensile Strength Test

c) Flexural Strength of Beam

Figure 3 illustrates the Flexural Strength Check using a 1.7-meter-long bar. The shaft is enclosed within the testing device, and pressure is continuously applied until the situation fails. Dodging within a bar can be calculated with the help of an LVDT.

Figure 3. Setting for Flexural Strength Tests

2. RESULTS AND DISCUSSION

a) Compressive Strength

Table 2 shows the advantages of compressive strength in large blocks. Figure 4 depicts the effects of the relationship between compressive strength of forms at 28 years earlier CB, FRCB1, FRCB2, FRCB3, HyFRCB1, HyFRCB2, HyFRCB3, HyFRCB4, and HyFRCB6. As a result, compressive strength in HFRC3 enhanced before progressively falling or remaining constant.

Table 2. Cubes Compressive Strength

S. No.	Specimens	% of Fiber dosage	No. of Specimens	Mean value of Compressive strength, N/mm^2
				28 days
1.	CB	-	3	40.67
2.	FRCB1	ST0.5	3	49.2
3.	FRCB2	RPET0.5	3	38.4
4.	FRCB3	PP0.5	3	40.3
5.	HyFRCB1	ST0.12PP0.38	3	43.1
6.	HyFRCB2	ST0.25PP0.25	3	49.2
7.	HyFRCB3	ST0.38PP0.12	3	52.1
8.	HyFRCB4	ST0.12RPET0.38	3	32.8
9.	HyFRCB5	ST0.25RPET0.25	3	35.1
10.	HyFRCB6	ST0.38RPET0.12	3	38.6

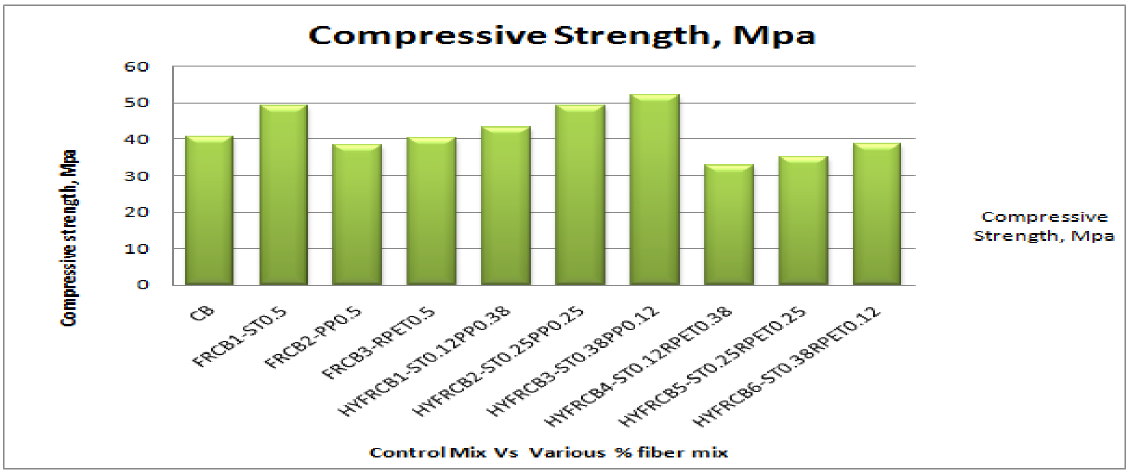

Figure 4. 28-day Cube Compressive Strength Test

b) Split Tensile Strength

The benefits of Split snap for large chambers are shown in Table 3. Figure 5 provides an overview of the correlation between the split snap of chambers at 28 years in the past for CB, FRCB1, FRCB2, FRCB3, HyFRCB1, HyFRCB2, HyFRCB3, HyFRCB4, and HyFRCB6. According to the findings, Split physical property was added to HyFRCB3 for M40 grade concrete and subsequently on either gradually decreased or remained same.

Table 3. Split Tensile strength on cylinders

Sl. No.	Specimens	% of Fiber dosage	No. of Specimens	Mean value of Split Tensile strength, N/mm^2
				28 days

1.	CB	-	3	4.1
2.	FRCB1	ST0.5	3	4.2
3.	FRCB2	RPET0.5	3	4
4.	FRCB3	PP0.5	3	4.3
5.	HyFRCB1	ST0.12PP0.38	3	4.12
6.	HyFRCB2	ST0.25PP0.25	3	4.6
7.	HyFRCB3	ST0.38PP0.12	3	4.8
8.	HyFRCB4	ST0.12RPET0.38	3	4.4
9.	HyFRCB5	ST0.25RPET0.25	3	4.6
10.	HyFRCB6	ST0.38RPET0.12	3	4.2

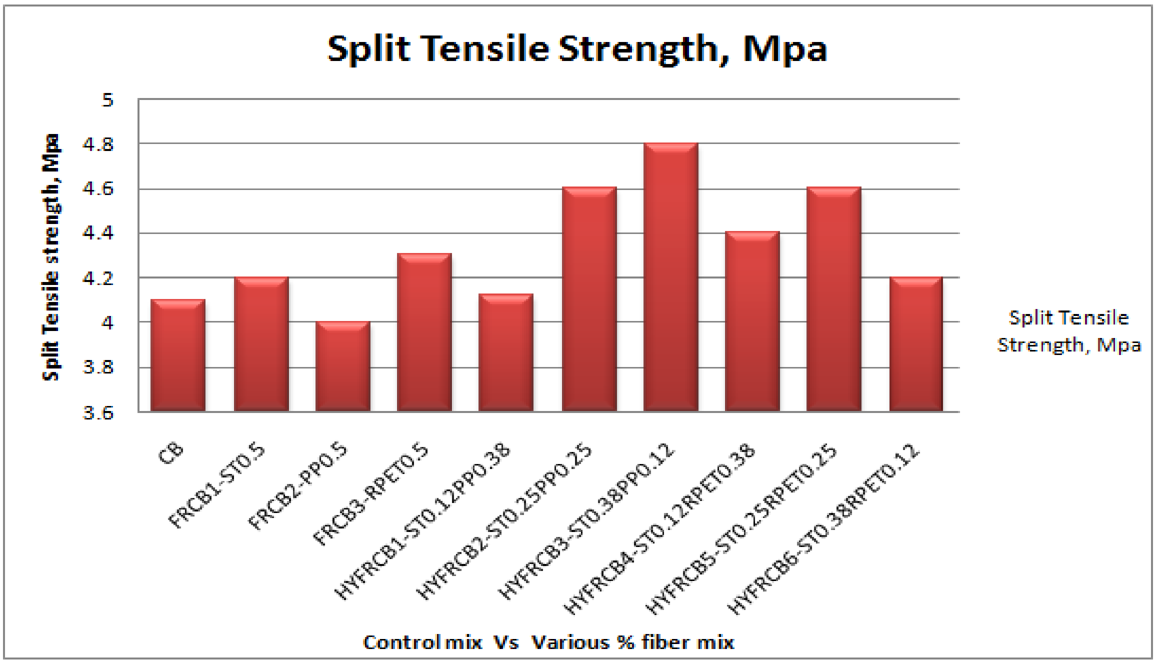

Figure 5. Cylinder Split Tensile Strength Test after 28 Days

c) Flexural Strength

The 10 additional shafts used in this offer unit of measurement were tested until they fell apart. Everyone who was lacking in the shafts unit of measurement offered almost little by way of trivial growing 2 point loads. The remaining 10 shafts used in this offer unit each tried till they gave out. Almost no by way of minor growing 2 point loads made every single one in everything regarding shafts units. The 10 additional shafts used in this offer unit were tested to the point of failure. Everyone who was left behind in the shafts unit offered almost little by way of pointless growing 2 point loads. 4.

Table 4. Beams Flexural Behaviour

Final parameters	Flexure Behaviour of Beams									
	CB	FRC B-1	FRCB-2	FRC B-3	HyFRCB -1	HyFRCB -2	HyFRCB -3	HyFRCB -4	HyFRCB -5	HyFRCB -6
Initial Crack	18	24	25	20	21	22	24	26	23	20
Ultimate Load	27	49	29	27	54	48	46	47	44	43
Ultimate Deflection	9	11.3	13.2	16.1	18.7	16.6	17.4	24	22.4	21.6
Yield load	16	18.2	15.4	12.4	27.3	24.2	24.8	25.6	24.1	21.4
Yield Deflection	4.5	6.7	7.7	8.2	13.8	12.4	12.6	13.5	14.2	10.1
Deflection Ductility	2.0	1.68	1.71	1.96	2.60	2.60	2.47	2.41	2.30	1.94
Stiffness at ultimate load	3	4.33	2.2	1.67	2.88	2.90	2.64	1.95	1.96	1.99
Stiffness at yield load	3.56	2.71	2.0	1.51	1.97	1.95	1.96	1.89	1.69	2.11

As a result, the reorientation is altered according to the stacking on the bar, and the avoidances resolve abuse Deflecto metres.. Because metal filaments contribute to excessive weight increase and polypropylene strands contribute to least redirection, shafts with excellent and polypropylene fiber mix thoroughbred least excusing. The heap shunned bent is shown in Figures 6 and 7. Each additional shaft used in this proposed unit of measurement was tested until it collapsed. With regard to shafts, everyone who was devoid of any information offered almost little by way of trivial growing 2 point loads. The 10 additional shafts used in this offer unit of measurement were tested until they fell apart. No one who was lacking in anything relating to shafts provided to almost anybody using insignificant increasing Two Figure 7.

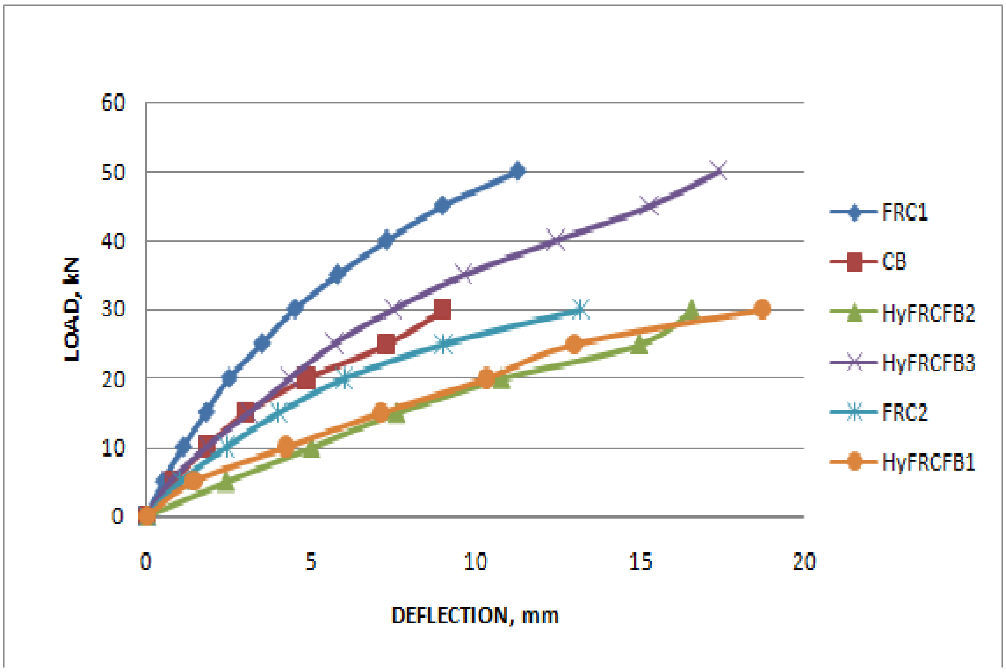

Figure 6. HFRC (Steel and PP) plot for LD

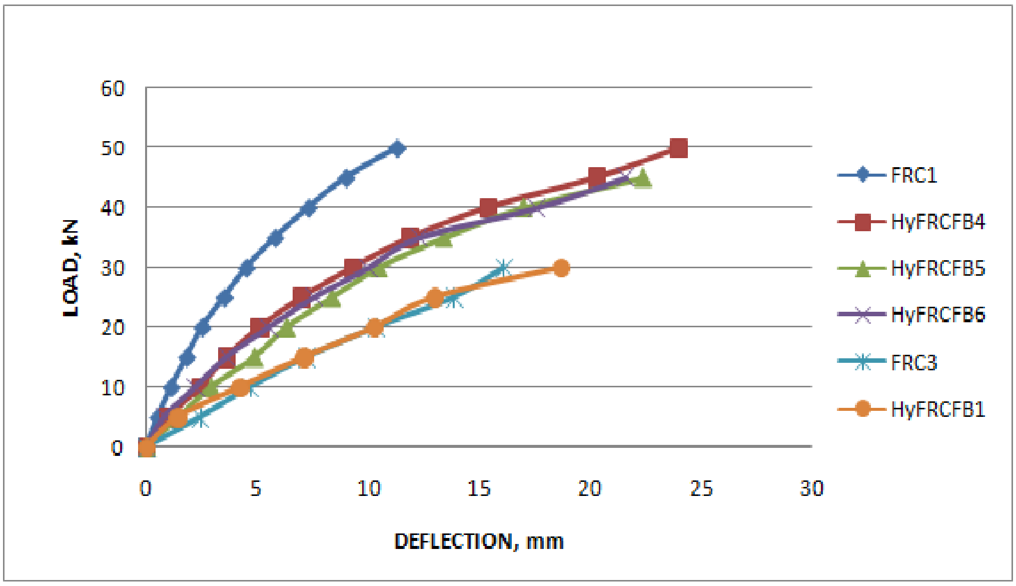

Figure 7. HFRC (Steel and RPET) plot for LD

3. CONCLUSION

The outcome of the research are presented below.

- ✓ "It was concluded that compressive strength, Split tensile strength and Flexural Strength was improved by hybrid fiber addition for M40 grade concrete. These values reached maximum for the fiber combination of ST0.38PP0.12."
- ✓ "Increasing the percentage of fiber in Hybrid combination reduces the slump value."
- ✓ "In order to maintain constant slump, super plasticizers content should be increased in concrete."
- ✓ "Addition of fibers in hybrid form was found to reduce the workability of HFRC over control concrete but at the same time hybrid fiber addition gave good compressive strength, Tensile and flexural strength to the concrete and also acts as a ductile material."
- ✓ "In order to improve the tensile strength of concrete, steel fiber was used and to improve the flexural behaviour of concrete, synthetic fibers available in market like RPET fiber and PP fibers were used"

- ✓ "From experiment results, it was clear that HyFRCFB1 with ST0.38RPET0.12 fiber combination was best in all strength and flexural parameters"
- ✓ "The experimental values of Deflection in beams were higher than the analytical values. Maximum deflection was observed in the HyFRCFB1 and the maximum variation between analytical and Experimental values was observed in FRCFB1."

REFERENCES

1. Krishnaraja, A., N. Sathishkumar, T.S. Kumar, P.D. Kumar (2014) Mechanical behaviour of geopolymer concrete under ambient curing. International Journal of Scientific Engineering and Technology. 3 (2):130-132.
2. Vignesh, P., A. Krishnaraja, N. Nandhini (2014) Study on mechanical properties of geo polymer concrete using m-sand and glass fibers. International Journal of Innovative Research in Science, Engineering and Technology. 3 (2):110-116.
3. Ravichandran, G., M. Sivaraja, A. Krishnaraja, M. Jegan, M. Harihanandh (2018) Study on mechanical properties of eco friendly geopolymer concrete under different curing temperatures. Technology. 9 (4):1324-1332.
4. Ravichandran, G., M. Sivaraja, M. Jegan, M. Harihanandh, A. Krishnaraja (2018) Performance of glass fiber reinforced geopolymer concrete under varying temperature effect. Technology. 9 (4):1316-1323.
5. M.Kumana Chakra Varthi, M.S., M.Jegan, A.R.Krishnaraja. (2020) Experimental Study on Hybrid Fiber Reinforced Composites using Waste Fibers. International Journal of Advanced Science and Technology. 29 (7):831-835.
6. M.Kumana Chakra Varthi, M.S., A.R.Krishnaraja , M.Jegan. (2020) Flexural Performance of Hybrid Fiber Reinforced Concrete Beams using Textile and Steel Fiber. International Journal of Advanced Science and Technology. 29 (7):844-848.
7. Krishnaraja A.R, T.A., Suryaprakash.S (2016) Experimental Studies on Properties of Engineered Cementitious Composites. South Asian Journal of Engineering and Technology. 2 (21):217-222.
8. Krishnaraja.A.R, G.A., Hari Prasath.T, Meianbesh.S (2017) Study on New Hybrid Engineered Cementitious Composites for Structural Application. International Journal of Scientific Engineering and Technology (ISSN: 2277-1581). 6 (4):132-134.
9. M. Krishnamoorthy, D.T., M. Sivaraja,A.R. Krishnaraja (2017) Durability Studies on Polyethylene Terephthalate (PET) Fiber Reinforced Concrete. International Journal of Civil Engineering and Technology. 8 (10):634-640.
10. A.R.Krishnaraja, S.K. (2017) Mechanical Properties of Engineered Cementitious Composites. International Journal of ChemTech Research. 10 (8):341-347.
11. Krishnaraja, A.R., S. Anandakumar, M. Jegan (2019) Mechanical performance of hybrid engineered cementitious composites. Cement wapno beton. 6:479-486.
12. A.R.Krishnaraja, S.K. (2017) Assessment of Mechanical Properties of Newly Developed Hybrid Engineered Cementitious Composites. Sciencia tecnica vitivinicola. 32 (8):95-109.
13. Krishnaraja, A.,S. Kandasamy (2017) Flexural performance of engineered cementitious composite layered reinforced concrete beams. Archives of Civil Engineering. 63 (4):173-189.
14. Krishnaraja, A.R.,S. Kandasamy (2018) Flexural Performance of Hybrid Engineered Cementitious Composite Layered Reinforced Concrete Beams. Periodica Polytechnica Civil Engineering. 62 (4):921-929.
15. Krishnaraja, A.R., S. Anandakumar, M. Jegan, T.S. Mukesh, K.S. Kumar (2019) Study on impact of fiber hybridization in material properties of engineered cementitious composites. Matérials (Rio de Janeiro). 24 (2).