

An Experimental Investigation on Hybrid Fibre Reinforced Self Compacting Concrete Containing Fly ASH, Sisal and Pet Strap Fibres

Rohini.B¹, Prof. Mrs.Sharada.S.A²

P G Student¹, Assistant professor²

Department Of Civil Engineering^{1,2}

SJCIT,Chickballapur^{1,2}

Abstract-Self compacting concrete is a concrete that flows under its own weight and it does not require any external compaction. And the fibers are added into the concrete for withstanding the propagation of cracks. These fibers are high resistivity against high tensile strength and temperature and to study this strength behavior of pet strap and sisal fibre self compacting reinforced concrete the various test specimens were casted such as cubes, cylinders and beams. In this experiment cement is replaced by 20% of fly ash. For a mix design proportion of 1:1.75:1.2 with a water cement ratio of 0.47 and In this experiment we are adding hybrid fibres like sisal and pet strap fibres with a dosage of 0.5%, 1%, 1.5% and 2% were dispersed into the concrete of mix design M40 grade concrete.

Key words-Compression test, Split tensile test, Flexural test, Sisal fibre, Pet strap fibre and Fly ash.

I. INTRODUCTION

Self compacting concrete is a concrete that flows under its own weight and it does not require any external compaction. And it involves three properties that characterize a concrete they are passing ability, flowing ability and resistance to segregation. And an addition of small closely spaced and uniformly dispersed fibres with concrete would substantially improve its strength and durability properties of the concrete and would act as a crack arrester. This concrete type is called as a self compacting reinforced concrete.

II. PROPERTIES OF MATERIALS

The concrete mix design has done as per IS code 10262-2019.

- **CEMENT**

In the present experimental study, OPC 53 grade cement is used. Cement is binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together.

- **FINE AGGREGATE**

M-sand is used as fine aggregate in this experiment. M-sand is a manufactured sand. Sand is either round or angular grain and is often found mixed in various grading of fineness at different zones.

- **COARSE AGGREGATE**

In the present work, locally available crushed stone aggregates of size 20mm to 4.75mm were utilized.

- **FIBRES**

As we know that the plain concrete having little resistance to cracking and have very low tensile strength. And internal micro cracks are present in the concrete which results in the poor tensile strength of concrete. In order to overcome such problems hybrid fibres are used in this experimental study. Fibres were used in this investigation are sisal and pet strap fibre. In this experiment we have procured the sisal and pet strap from the Bangalore.

- **SISAL FIBRE**

Sisal fibre (AGAVE SISALANA) is one of the fibre which is widely used as a natural fibre. It is obtained from sisal plant. The sisal fibres can be removed in process known as 'decortications'.

- **PETSTRAP FIBRE**

Polyethylene Terephthalate is a synthetic material referred as pet Strapping, which means process of bundling with help of various straps and strapping tools. Pet strap is a strong material used for packaging of various goods.

- **FLY ASH**

Fly ash is a byproduct from burning pulverized coal in electric power generating plants. During combustion, mineral impurities in the coal (clay, feldspar, quartz and shale) fuse in suspension and float out of the

combustion chamber with the exhaust gases. As the fused material rises, it cools and solidifies into spherical glassy particles called fly ash

- **CONPLAST SP430**

Conplast SP430 conforms with ASTM C494 as Type A and Type F, depending on dosage used. It is a chloride free, superplasticising admixture based on selected sulphonated naphthalene polymers. Specific gravity of this superplasticizer is 1.18.

- **WATER**

The Potable water is used for the project work and which is free from chloride.

Table 1: Properties of the fibres used

MATERIALS	PROPERTIES	VALUES USED	IMPORTANCE
Sisal fibre	Aspect ratio	50	Increase in the flexural and compressive strength in t respectively
	Length	4.5cm	
	Diameter	0.09mm	
	Dosage in % to the weight of cement	0.0.5,1,1.5,2	
PET strap fibre	Aspect ratio	20	Increases the tensile and flexural strength and it can be recyclable.
	Length	4cm	
	Diameter	2mm	
	Dosage in % to the weight of cement	0,0.5,1,1.5,2	

III. METHODOLOGY

Present project is focused on the comparison between the conventional concrete and self compacting fibre reinforced concrete using hybrid fibre (petstrap and sisal fibre). From the test results the concrete mix design prepared as per IS 10262-2019 for concrete grade mix M40.

- **Compressive Strength Test on Cubes**

With reference to Indian standard (IS 516:1959) compression test is conducted on specimens of size 150*150*150mm confirming IS10086:1982. After the required days of curing i.e. 7, 14, 28and 56 days, specimens are tested under compression testing machine (CTM). Compression strength is known as capacity of a material to withstand load tending for reducing load or for being pushed together. Test was carried out at the laboratory of department of civil engineering, SJGIT, Chickballapur. Testing machine have a capacity of 200 tons. Total 3 specimens for each percentage of fibres were tested and compression strength was determined.



Fig 1:Testing of cube

➤ **Split tensile strength test on cylinders**

A direct measurement of ensuring tensile strength of concrete is difficult. One of the indirect tension test methods is split tension test. The split tensile strength test was carried out on the compression testing machine.



Fig 2: Testing of cylinder

- **Flexural strength test on beams**

With reference to Indian standard code of (IS 516:1959) flexural test is conducted on specimens of size 100*100*500mm. After the required days of curing i.e. 7days, 14days and 28days and 56 days, specimens are tested under universal testing machine. It is also known as modulus of rupture.



Fig 3: Testing of beam

IV. RESULTS SECTION

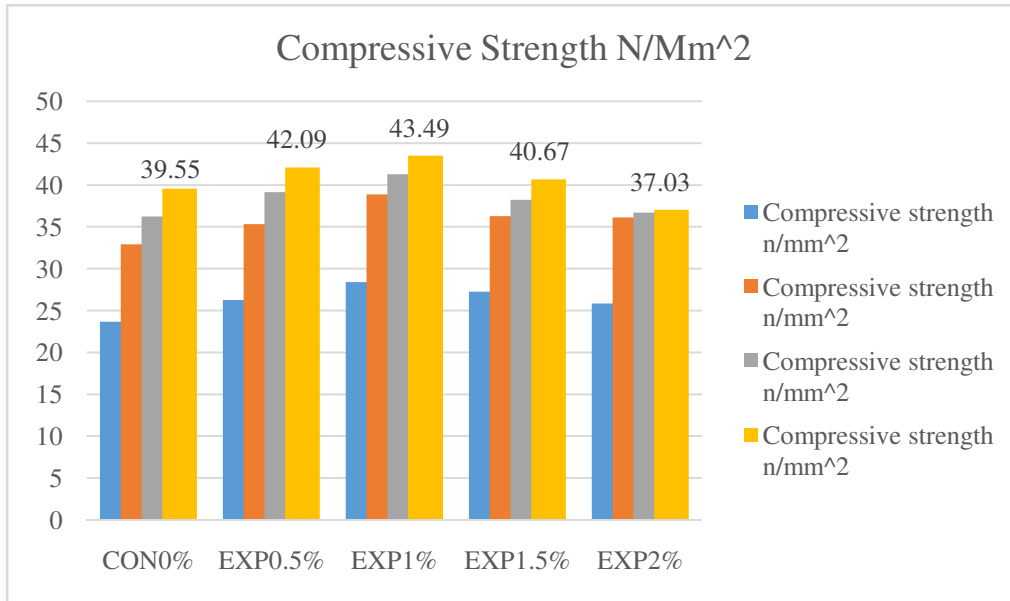
By adding sisal and pet strap fibre into the concrete there will be increase in the strength of the concrete when compared to the conventional concrete. And has shown below in the table compressive, split tensile and flexural strength has been increased by adding 1% of hybrid fibres.

➤ **COMPRESSIVE STRENGTH RESULTS**

TABLE 4.2 COMPRESSIVE STRENGTH RESULTS.

Sl. no	Type of Mix	Compressive strength n/mm ²			
		7days	14days	28days	56days
1	CON0%	23.65	32.91	36.22	39.55
2	EXP0.5%	26.26	35.33	39.14	42.09

3	EXP1%	28.4	38.88	41.28	43.49
4	EXP1.5%	27.27	36.29	38.24	40.67
5	EXP2%	25.84	36.11	36.71	37.03



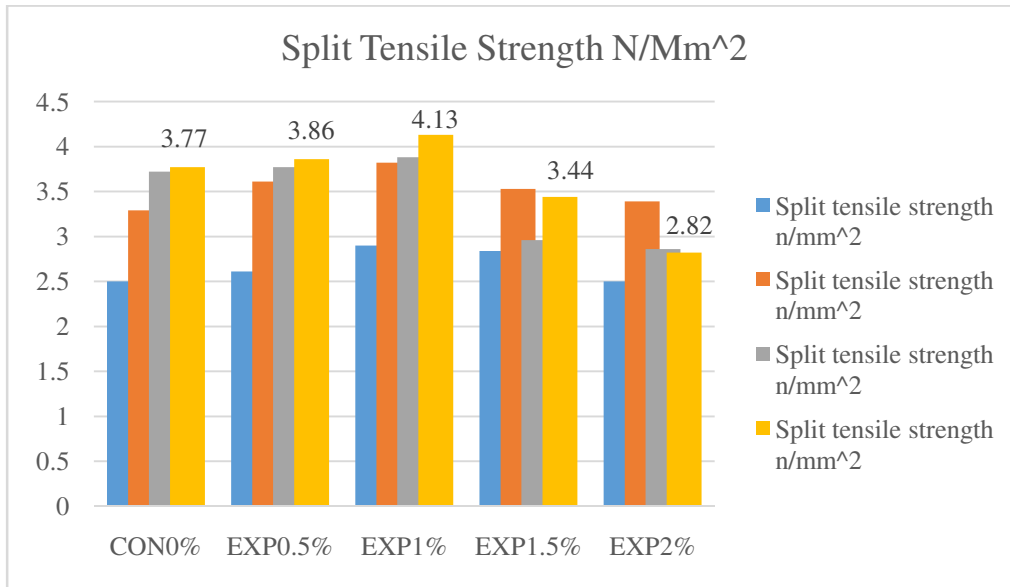
GRAPH 4.1 COMPRESSIVE STRENGTH GRAPH

➤ **SPLIT TENSILE STRENGTH RESULTS**

TABLE 4.3 SPLIT TENSILE STRENGTH RESULTS

Sl. no	Type of Mix	Split tensile strength n/mm ²			
		7days	14days	28days	56days
1	CON0%	2.50	3.29	3.72	3.77
2	EXP0.5%	2.61	3.61	3.77	3.86

3	EXP1%	2.90	3.82	3.88	4.13
4	EXP1.5%	2.84	3.53	2.96	3.44
5	EXP2%	2.50	3.39	2.86	2.82



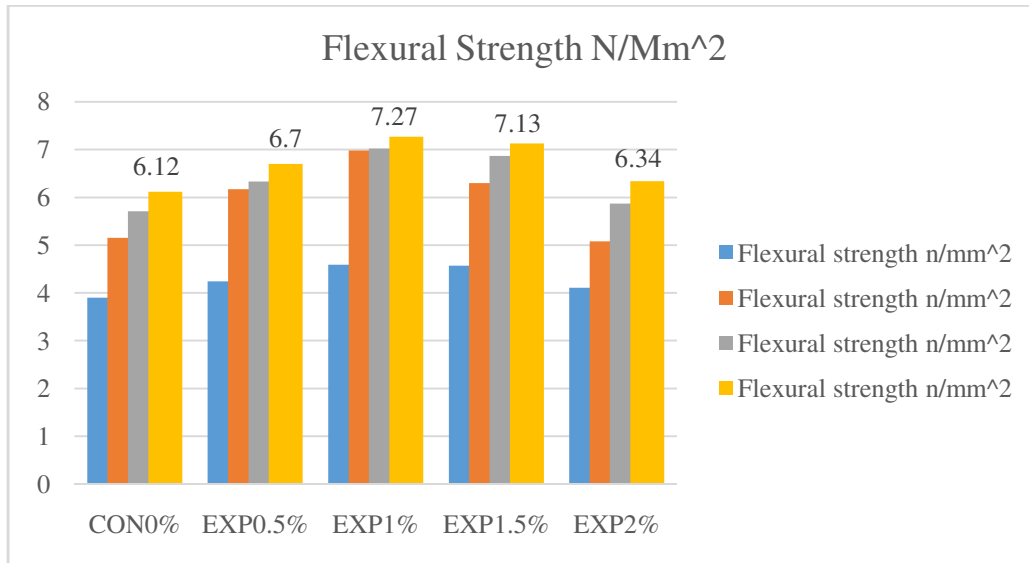
GRAPH 4.2 SPLIT TENSILE CHART

➤ **FLEXURAL STRTENGTH RESULTS**

TABLE 4.4 FLEXURAL STRENGTH RESULTS

Sl. no	Type of Mix	Flexural strength n/mm ²			
		7days	14days	28days	56days
1	CON0%	3.90	5.15	5.71	6.12
2	EXP0.5%	4.24	6.17	6.33	6.7

3	EXP1%	4.59	6.98	7.02	7.27
4	EXP1.5%	4.57	6.30	6.87	7.13
5	EXP2%	4.11	5.08	5.87	6.34



GRAPH 4.3 FLEXURAL STRENGTH GRAPH

CONCLUSIONS

- The study has been concluded that the compressive strength, split tensile strength and flexural strength test results shows that the strength of 1% of sisal and pet strap fibre reinforced concrete has increased gradually with respect to conventional concrete.
- Hence it is recommended that sisal and pet strap fibre reinforced concrete gives better result compared to conventional concrete.
- Minimal cracks in the tested specimens indicate that the fibers were effective in improving the cracking resistance of concrete.

SCOPE FOR FUTURE WORK

- Use of mixed fibre in the concrete mix is a new concept in construction.
- Future work can be carried out using different fibre combination in the mix to get even better results.
- Future work can be carried out to determine the different strength parameters.
- Effective utilization of fibres in the concrete mix by increasing its % up to 100% to determine the strength parameters.

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