EXPERIMENTAL STUDY ON BEHAVIOUR OF BASALT FIBER REINFORCED CONCRETE FILLED STAINLESS STEEL TUBE AND MILD STEEL TUBE

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ABSTRACT

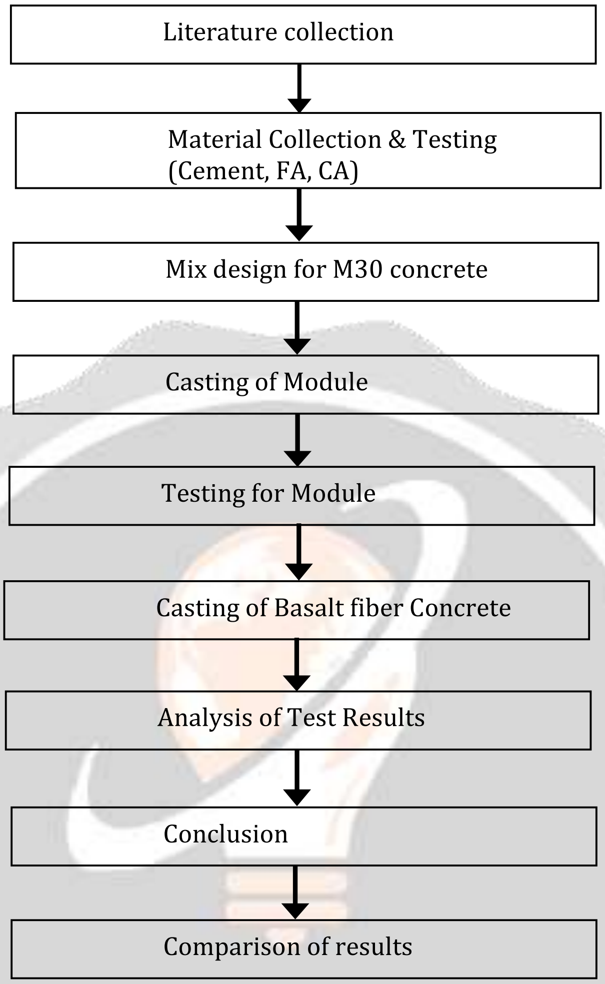
Concrete Filled Steel Hollow Section (CFSHS) Columns can carry important loads and therefore they are extensively used in the construction of high-rise buildings. Steel-concrete composite (SCC) columns have widely been applied in modern construction industry owing to the composite action between the concrete and the steel. Composite columns are structural members which are subjected mainly to axial compressive forces and end moments. CFST columns are type of composite column. This type of columns can offer many advantages like high strength, ductility and large energy absorption capacity with possible use of simple standardized connections. This paper is based on the experimental study of slender steel tubular columns of circular sections filled with reinforced concrete and partial replacement of cement by basalt fiber. The detail study about the nature and properties of the materials by various tests and the mix proportion is designed in phase I. As the continuation in phase II standard specimens will be casted and cured for 28 days to get the compressive strength, flexural strength and split tensile strength. Then the final result is evaluated by comparing the above strengths of basalt fiber reinforced concrete filled stainless steel tube column and mild steel tube column.

Keywords: *Flexure test, Reinforcement, GFRP, compressive strength test, tensile test*

1.INTRODUCTION

The world is noticing a transformation in construction practices along with new aspects of development fueled by the accelerated economic growth and high rate of urbanization. The construction industry must keep up with the advanced technology and systems to cope up with the modern trends and demands.In concrete production, about 60% to 80% of aggregate is composed by volume. Both fine and coarse aggregate is used in concrete. The utilization of sand as fine aggregate in the construction industry has increased by an alarming rate. To cater to this increasing demand the industry is facing difficulty in the supply of natural river sand. To overcome that situation, construction industries have identified alternatives like manufactured sand, robo sand, marble dust etc. Another alternative to this can be use of basalt fiber in concrete.Also, many civil engineering infrastructures are no longer considered safe due to increase load specifications in the design codes or due to lack of quality control. In the order to prolong local buckling, prohibit excessive concrete spalling frame construction, therefore the concrete filled steel tube (CFST) columns are implemented.

2. METHODOLOGY



3. PROPERTIES OF BASALT FIBERS

S. NO	PROPERTY	VALUE
1	Tensile Strength	2.8-3% GPa
2	Elastic Modulus	85-87 GPa
3	Elongation at Break	3.15%

4	Density	2.67 g/cm^3
5	Length	12mm

4. TEST ON CONCRETE

- Compressive Strength Test
- Flexural Strength Test
- Split Tensile Strength Test

COMPRESSIVE STRENGTH TEST AT 7 DAYS: -

MIX DESIGNATION	COMPRESSIVE STRENGTH NORMAL MIX, in N/mm²	COMPRESSIVE STRENGTH 0.5% FIBER, in N/mm²	COMPRESSIVE STRENGTH 0.75% FIBER , in N/mm²	COMPRESSIVE STRENGTH 1% FIBER , in N/mm²
1	18.94	20.32	15.20	11.49
2	16.90	20.50	17.40	14.50
3	13.70	17.40	16.80	12.56
AVERAGE COMPRESSIVE STRENGTH , in N/mm²	**17.94**	**18.94**	**16.46**	**12.80**

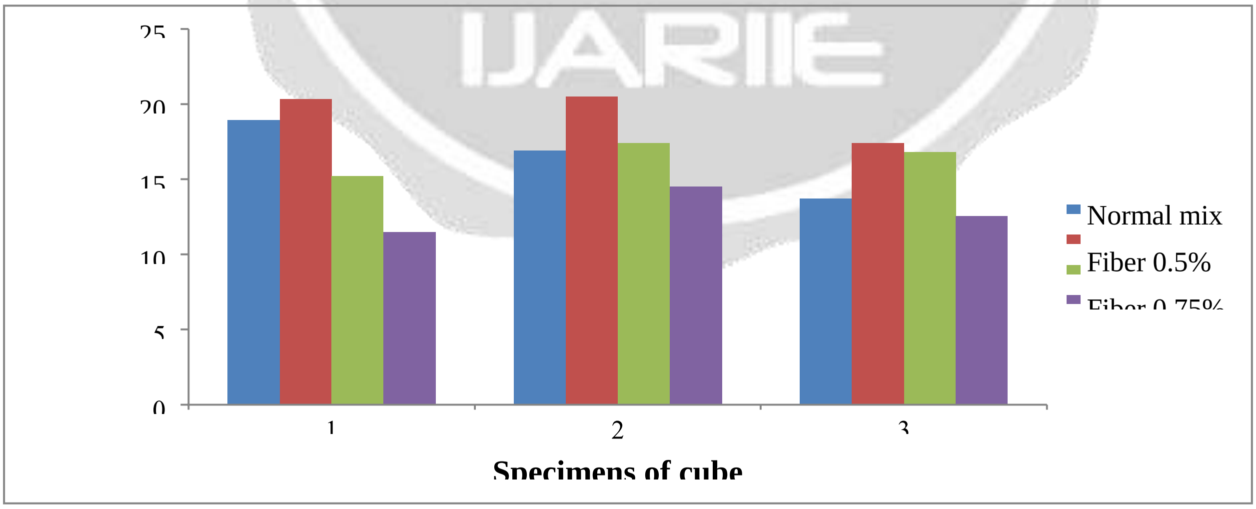


Figure 1: Graph for Compressive strength Test.

COMPRESSIVE STRENGTH TEST AT 14 DAYS: -

MIX DESIGNATIO N	COMPRESSIVE STRENGTH NORMAL MIX, in N/mm^2	COMPRESSIVE STRENGTH 0.5% FIBER, in N/mm^2	COMPRESSIVE STRENGTH 0.75% FIBER , in N/mm^2	COMPRESSIVE STRENGTH 1% FIBER , in N/mm^2
1	28.6 0	42.60	31.40	26.00
2	29.90	47.00	34.20	16.00
3	28.25	44.00	33.80	22.00
AVERAGE COMPRESSI VE STRENGTH , in N/mm^2	**28.92**	**44.53**	**33.27**	**21.33**

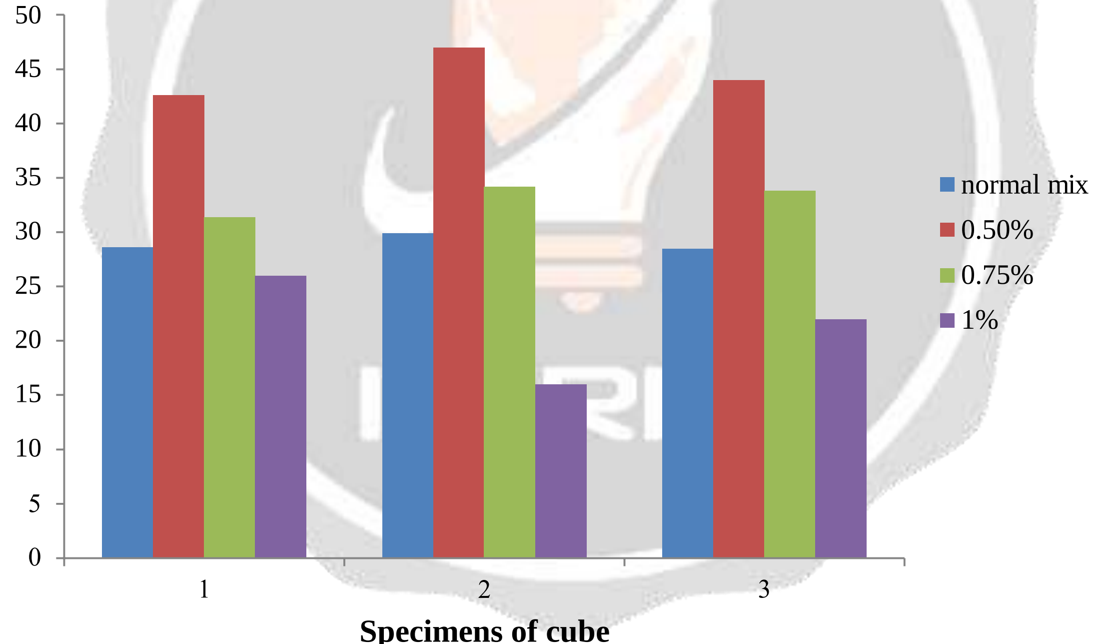


Figure 2: Graph for Compressive strength Tes

COMPRESSIVE STRENGTH TEST AT 28DAYS: -

MIX DESIGNATION	COMPRESSIVE STRENGTH NORMAL MIX, in N/mm^2	COMPRESSIVE STRENGTH 0.5% FIBER, in N/mm^2	COMPRESSIVE STRENGTH 0.75% FIBER , in N/mm^2	COMPRESSIVE STRENGTH 1% FIBER , in N/mm^2
1	30.2	52	31.8	32.1
2	36.6	46.05	33.8	28.2
3	32.2	52.85	35.6	29.0
AVERAGE COMPRESSIVE STRENGTH , in N/mm^2	**33.0**	**50.3**	**33.73**	**29.77**

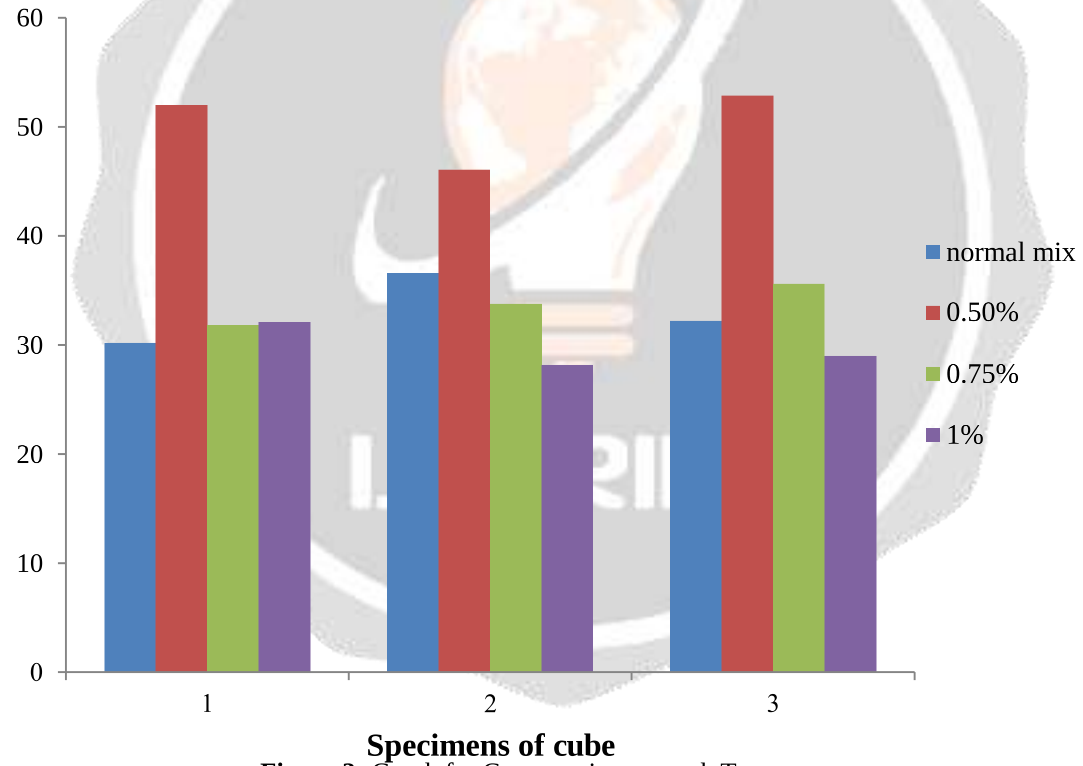


Figure 3: Graph for Compressive strength Test.

FLEXURAL STRENGTH TEST OF BEAM : -

MIX DESIGNATION	FLEXURAL STRENGTH NORMAL MIX, in N/mm^2	FLEXURAL STRENGTH 0.5% FIBER, in N/mm^2	FLEXURAL STRENGTH 0.75% FIBER , in N/mm^2	FLEXURAL STRENGTH 1% FIBER , in N/mm^2
1	7.72	7.6	7.8	5.7
2	6.48	7.51	6.9	5.15
3	6.28	7.33	7.12	5.49
AVERAGE FLEXURAL STRENGTH , in N/mm^2	**6.83**	**7.48**	**7.12**	**5.45**

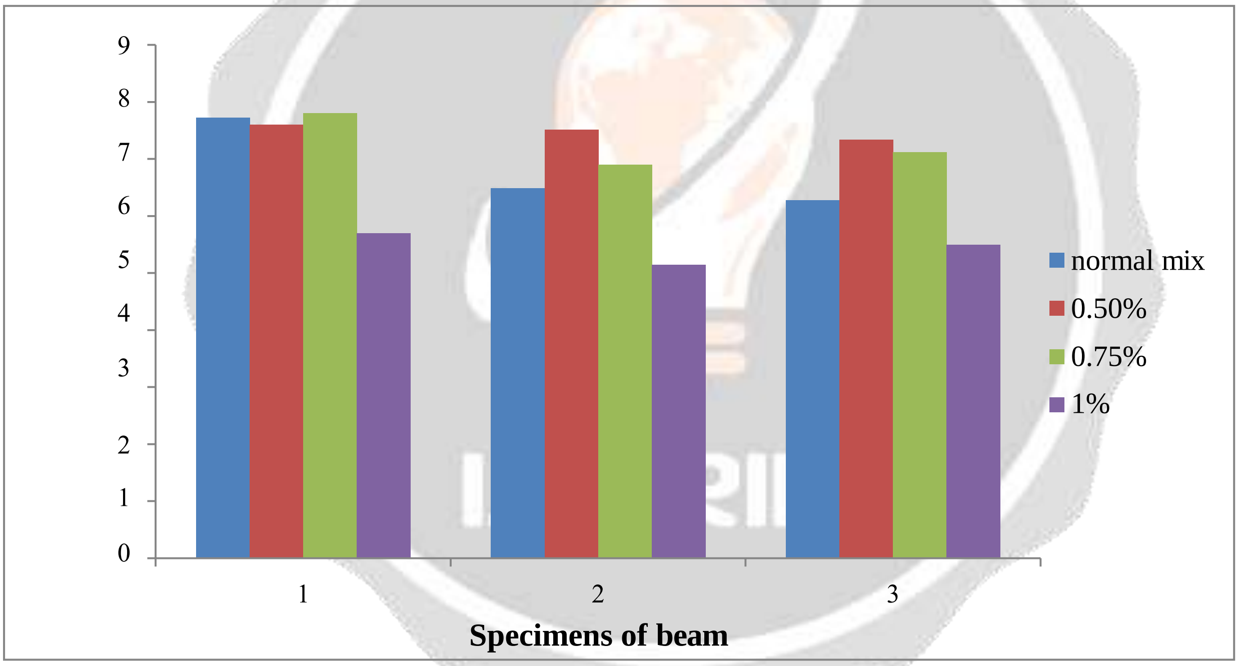


Figure 4: Graph for Flexural strength Test.

SPLIT TENSILE STRENGTH TEST OF CYLINDER: -

MIX DESIGNATION	TENSILE STRENGTH NORMAL MIX, in N/mm^2	TENSILE STRENGTH 0.5% FIBER, in N/mm^2	TENSILE STRENGTH 0.75% FIBER , in N/mm^2	TENSILE STRENGTH 1% FIBER , in N/mm^2
1	3.47	4.80	4.03	2.430
2	4.92	4.31	3.98	2.426
3	3.57	4.54	3.83	2.413
AVERAGE TENSILE STRENGTH , in N/mm^2	**3.99**	**4.55**	**3.95**	**2.423**

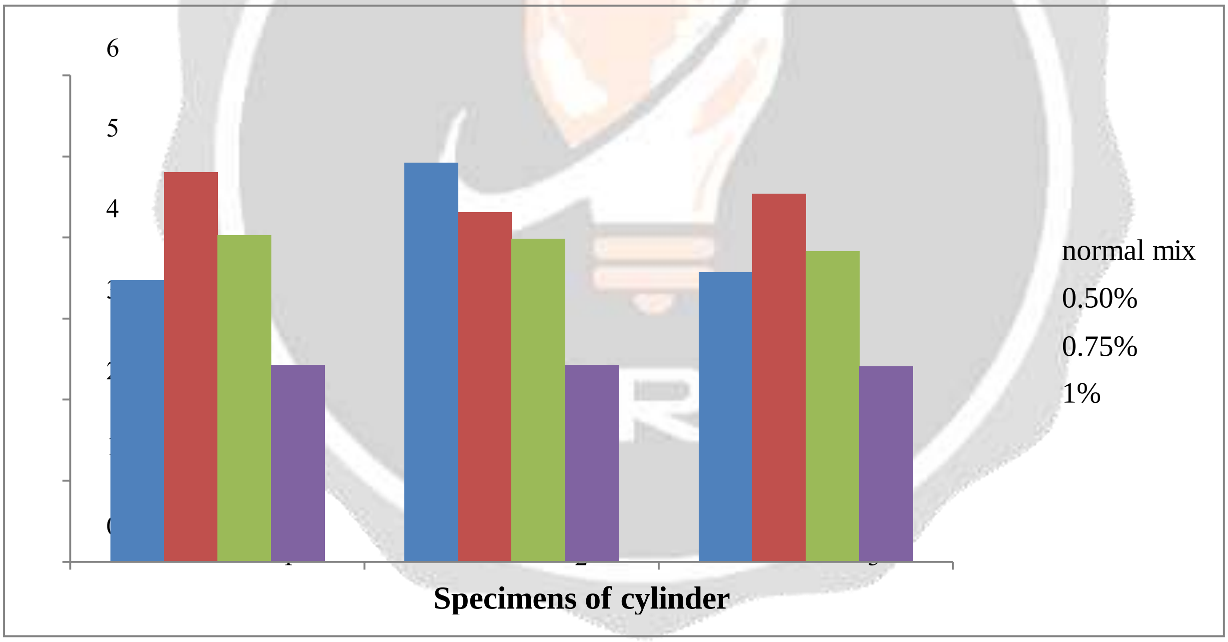


Figure 5: Graph for Tensile strength Test.

5. CONCLUSSION

Based on the experiment studies carried out on the basalt fiber reinforced concrete filed stainless and mild steel tube, the following conclusions are made: -

- The compressive strength of the concrete has increased 52.42% in 0.5% of basalt fiber compared to the other mix proportion.
- The tensile strength of the concrete has increased 14.04% in 0.5% of basalt fiber compared to the other mix proportion.
- The flexural strength of the concrete has increased 9.52% in 0.5% of basalt fiber compared to the

other mix proportion.

- The concrete filled steel tube columns have a higher load carrying capacity. By varying slenderness ratio, it is observed that the shorter column has higher load carrying capacity.
- Mild steel tube of height 200mm having 0.75% of basalt fiber has higher strength and load carrying capacity compared to the height 300mm and 400mm.
- Stainless tube of height 200mm having 0.75% of basalt fiber has higher strength and load carrying capacity compared to the height 300mm.
- Bond strength of mild steel tube is more compared to stainless steel.
- Overall, Mild steel tube has more strength compared to stainless steel due to the bonding strength between steel and concrete.

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