

# Experimental Study on Fly Ash Based Slurry Infiltrated Fiber Concrete Beam Incorporate with Lathe Waste

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**Abstract:** The main responsibility of a Civil Engineer is to provide a safe working environment to future developments. The ultimate objective of this study is to know the behavior of SIFCON beam while adding lathe waste into that. SIFCON have high strength as well as large ductility because of its tensile strength was high. In this experiment is done in two stages. In initial stage fly ash must be added in the various proportion, i.e. 10%, 20%, 30%, 40%, 50% and 60% from which optimum fly ash additive is obtained. In addition to that lathe waste is added to concrete in various proportion, i.e. 2%, 4%, 6% and 8% is done to get optimum lathe waste level. At the age of 28 days the SIFCON beam is tested up to failure for determining its structural behavior.

**Keywords:** Deflection, Ductility factor, Flexural strength, Fly ash, Steel fiber (Lathe waste), Stiffness.

## I. INTRODUCTION

Concrete is the widely used construction material in the entire world. There are many varieties of concrete is used over the globe for achieving good compression strength, high durability and good aesthetic elevation depends on the needs. But this construction material has some disadvantages, these tensile strength, energy absorption and ductility are comparatively low. By adding fibers into the concrete, the above-mentioned disadvantages are stunned. A new material introduced in construction, i.e., SIFCON. It is totally diverse from normal controlled fiber reinforced concrete. They are fiber content and method of production [1 - 3]. The fiber content is usually varying from 1% to 3% by volume in fiber reinforced concrete, at the same time in SIFCON the fiber content varies between 4% to 20% [4]. Slurry Infiltration may be affected by the steel fiber content due to higher percentage. Compensate this disadvantage by adding some superplasticizer to increase the strength of the beam [5 - 7]. In such cases the electronic wastes are added to concrete for higher stability of concrete and strength. Higher

water cement ratio is needed for SIFCON because this is a slurry infiltrated concrete it always requires higher water content [8 - 10]. Major four variables are considered while evaluating SIFCON as considered as a specimen. These variables are mentioned below:

- Slurry strength
- Fiber volume
- Fiber alignment and
- Fiber type

The above-mentioned variables are characterized and compared to one another. If the fiber volume and fiber fraction increases, it leads to bleeding and lose of concrete strength [11]. At the same time, it will increase the ductility also. The optimum fiber content (lathe waste) has increase the following properties:

- Bearing strength
- Tensile strength
- Fatigue
- Spelling resistance
- Energy absorption
- Impact resistance
- Friction resistance

In future, the E-waste is added to SIFCON and it helps to know how the strength varied between lathe waste and E-waste [12 - 15].

## II. MATERIALS

### A. Cement

Cement used for casting was Ordinary Portland Cement (53 grade).

### B. Fly Ash

Class F Fly ash were used for entire investigation. Fly ash were collected from the nearer fly ash brick production unit.

*C. Fine Aggregate*

River sand is used for entire investigation. It will always gives better run when compared to manufacturing sand.

*D. Coarse Aggregate*

Angular aggregate is used for entire investigation. The size of the aggregate may vary from 12 mm to 20 mm.

*E. Water*

Locally available potable water confirming to standard specified in IS: 456-2000 is used.

*F. Steel Fiber*

Steel fibers are collected from the nearer scrap waste unit (Lathe waste). This is what used as a steel fiber.

*G. Reinforcement*

Steel main reinforcement- HYSD bars of 8 mm diameter, Steel shear reinforcement - HYSD bars of 6 mm diameter.

*H. Mix Deign*

The Mix proportion for conventional concrete is designed using IS: 10262-2009. Materials required for 1 m<sup>3</sup> of concrete in ordinary grade concrete (M 30) is 1:1.16:2.81:0.45. The SIFCON mix proportion is taken as 1:1 and optimum fly ash value is 50% and the optimum lathe waste value is 8% by volume.

*I. Reinforcement Detail*

The reinforcement details of beam are shown in Fig. 1.

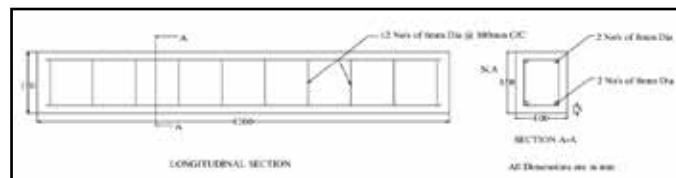


Fig. 1: Reinforcement Detail

III. RESULTS AND DISCUSSION

*A. Load Deflection Behaviour*

Cyclic loading was applied to the specimen. In every cycle load will be gradually increased. Totally 3 cycles of loading were

imposed on the beam. The ultimate load of 33N was recorded in last cycle. The deflection measured at center, during the last cycle deflection is 14.55 mm.

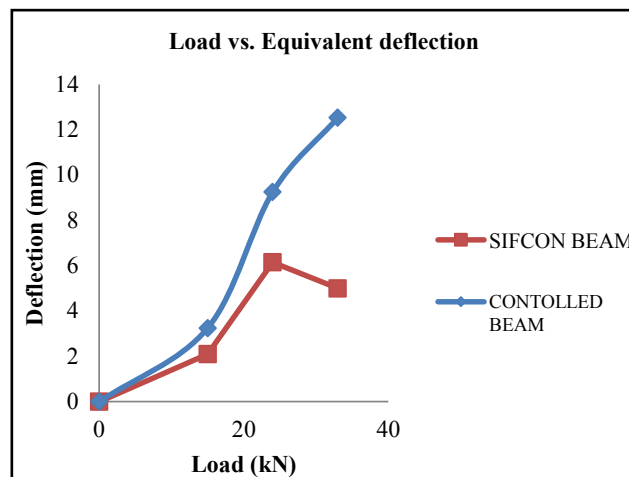


Fig. 2: Load Deflection Curve

*B. Stiffness*

From the results the stiffness of Slurry Infiltrated Concrete (SIFCON) beam was 12.50 kN/mm in the first cycle 5.75 kN/mm in the second cycle and 1.40 kN/mm in the third cycle. It was observed that stiffness is decreases every cycle. The stiffness is tabulated in Table I and shown graphically in Fig. 3.

TABLE I: STIFFNESS VS. LOAD CYCLES

Cycle No.	Max. Load (kN)	Max. Deflection (mm)	Stiffness (kN/mm)
1	15	2.1	12.50
2	24	6.15	5.75
3	33	14.55	1.40

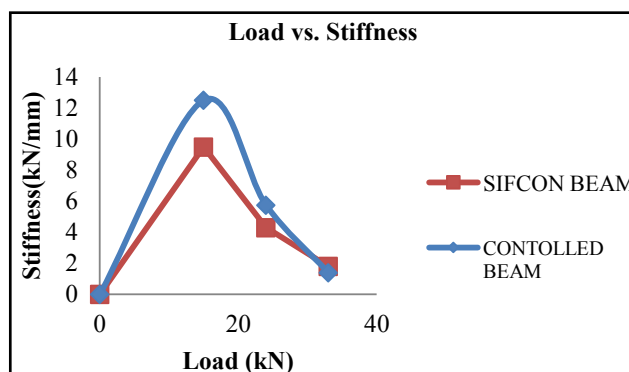


Fig. 3: Stiffness Vs. Load Cycles

*C. Cumulative Ductility Factor*

Ductility is an important property of a material to identify the maximum strength while external pressure is applied. In each

cycle the ductility value has 0.88 in the first cycle, 3.44 in the second cycle and 9.51 in the third cycle. From the results in my point of view the ductility increased every cycle. Table II shows the Cumulative Ductility Vs. Load Cycles and Fig. 4.

TABLE II: CUMULATIVE DUCTILITY VS. LOAD CYCLES

Cycle No.	Max. Load (kN)	Ductility	Cumulative Ductility
1	15	0.88	0.88
2	24	2.56	3.44
3	33	6.06	9.51

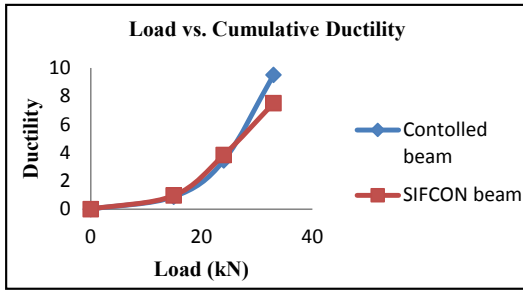


Fig. 4: Cumulative Ductility Vs. Load Cycles

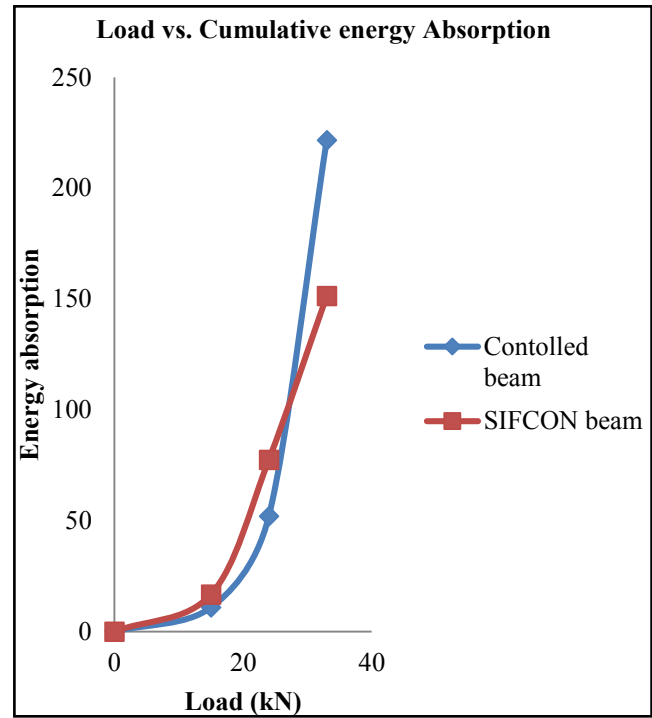


Fig. 5: Cumulative Energy Absorption Vs. Load Cycles

D. Cumulative Energy Absorption Factor

The cumulative energy absorption factor was observed from the test results given in Table III. The cumulative energy absorption was 10.85 kN.mm in the first cycle, 62.84 kN.mm in the second cycle and 284.48 kN.mm in the third cycle. From the observation cumulative energy absorption factor was increased cycle by cycle. Fig. 5 shows the Cumulative Energy Absorption Vs. Load cycles.

TABLE III: CUMULATIVE ENERGY ABSORPTION VS. LOAD CYCLES

Cycle No.	Max. Load (kN)	Energy Absorption (kN.mm)	Cumulative Energy Absorption (kN.mm)
1	15	10.85	10.85
2	24	51.99	62.84
3	33	221.64	284.48

IV. CONCLUSION

From the experimental and analytical work presented in this investigation, the following may be concluded. SIFCON beam test results were compared to RC control beam.

- The ultimate load of SIFCON beam were 80% more than controlled RC beam.
- The stiffness of flexural beam with SIFCON beam were 105% more than controlled RC beam.
- The optimum content of fly ash is 40% and optimum fiber content is 4% while fly ash and lathe waste added.
- SIFCON beam is 78% higher ductility with compared to RC control beam.
- The energy absorption capacity of flexural beam with SIFCON beam were 175% more than controlled RC beam.

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