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STUDY ON FLEXURAL BEHAVIOUR OF STEEL FIBRES IN TENSION ON RC MEMBERS

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Abstract *Most widely used material in constructions is concrete. Concrete plays an important role in construction, because of its good workability, and ability to be moulded to any shape. Though concrete has good workability, it fails in brittle condition because of its poor resistance to tensile loading, and its leads to formation of internal cracks in their structures. In order to reduce this effect and increasing the strength of concerte, increasing the durability of the concrete, many fibres are used. As compared to other fibres it is now proved that the steel fibre has the properties of resistance to cracking, and has resistance to deflection. As the beam is strong in compression and weak in tension, it is recommended to use the steel fibres only on the tension zone. When compared to the usage of steel fibre on throughout depth of the beam, the usage of steel fibre on the tension zone will have same flexural strength. Therefore the amount of steel fibre will be reduced and it is cost effective.*

***Key Words*: durability, economic, flexural strength, Steel fibre reinforced concrete, strength, tension zone**

1.INTRODUCTION

Concrete is the most economically used material for construction works. Through it has high strength and durability, it can be increased by adding many admixtures. In that case steel fibres plays an important role in construction works [1-2]. In this paper we can prove that the concrete mixed with steel fibre possess high strength. The steel fibre should be added at the ratio of 3% by the weight of concrete [3]. A beam is tested for the flexure strength of concrete and comparing the flexural strength between conventional concrete, beam with steel fibre mixed concrete for the full depth of beam and beam with steel fibre mixed for the half depth of the beam[4-5]. As the beam is strong in compression and weak in tension, the steel fibre mixed concrete for the half depth of beam is enough to resist the load acting on it[6].

1.1 Material used

1. Cement
2. Fine aggregate
3. Coarse aggregate
4. Steel fibre
5. Reinforcement bars

Cement of OPC , 43grade confining to IS456:2000, and specific gravity of 3.15, fine aggregate of specific gravity 2.64, water absorption 1%, and coarse aggregate of specific gravity 2.78, water absorption of 0.6% were taken. Steel fibre of length 35mm, 0.5mm diameter hook end fibre is used. Water cement ratio is 0.45. M30 grade concrete of ratio 1:1.47:2.4.

1.2 TYPES OF BEAM TESTED FOR FLEXURAL STRENGTH

1. Conventional beam
2. Beam with steel fibre on full depth
3. Beam with steel fibre only on tension zone.

2. FLEXURAL STRENGTH

The flexural strength, also known as modulus of rupture, or bend strength, or transverse rupture strength is a material property, defined as the stress in a material just before it yields in a flexure test[7-9].

Thus the flexural strength is tested for various types of beam, including steel fibre on full depth and half depth.

The flexural strength is calculated by two point loading method [10-11]. As the load increases the beam undergo deflection, therefore the deflection of the beam is also calculated.

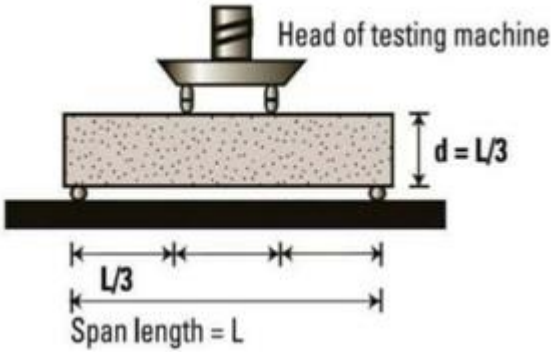

Fig -1: loading diagram

3 CRACK PATTERN AND FLEXURAL STRENGTH

3.1 CONVENTIONAL BEAM

Fig -2: crack pattern on conventional beam

The load at which beam fails = 90KN
Deflection = 20mm
The flexural strength of beam = 18.44 N/mm^2

3.2 BEAM WITH STEEL FIBRE ON FULL DEPTH

The load at which beam fails = 100KN
Deflection = 15mm
The flexural strength of beam = 20.44 N/mm^2 .

Fig –3: crack pattern of beam with steel fibre on full depth

3.3 BEAM WITH STEEL FIBRE ON HALF DEPTH

Fig -4: crack pattern of beam with steel fibre on tension zone

The load at which beam fails = 100 KN
Deflection = 15mm
The flexural strength of beam = 20.44 N/mm^2 .

Table -1: Comparing the result of various beam

S.NO	TYPES OF BEAM	LOAD KN	DEFLECTION mm	FLEXURAL STRENGTH N/mm^2
1	Conventional beam	90	20	18.4
2	Beam with SF on full depth	100	15	20.44
3	Beam with SF on tension zone	100	15	20.44

4. GRAPHICAL REPRESENTATION

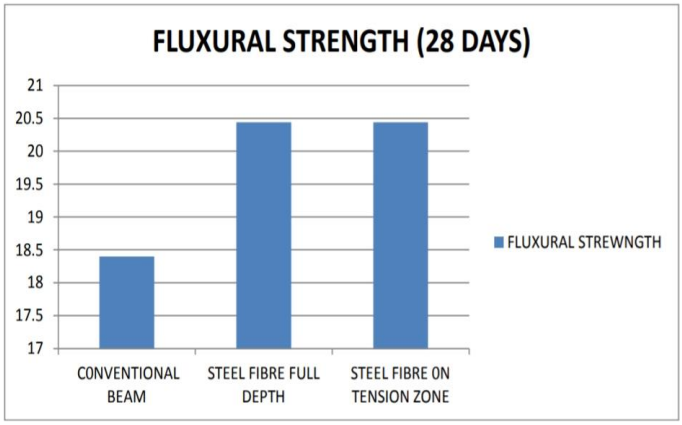

Chart -1: Flexural strength

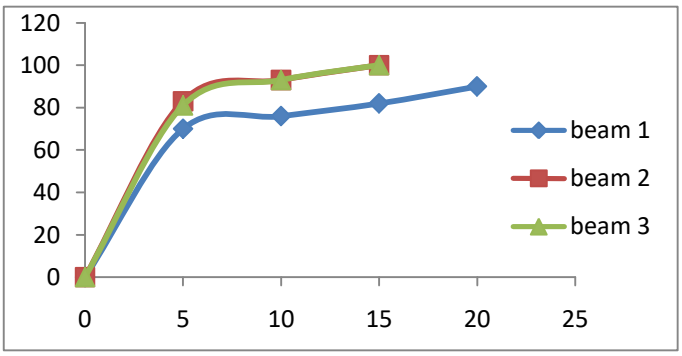

Chart-2: Load deflection curve

Beam 1- conventional beam
Beam 2- beam with steel fibre on full depth.
Beam 3- beam with steel fibre on half depth.

6. CONCLUSIONS

Detailed material test, fresh concrete test and hardened concrete test were conducted in the lab and the conclusion were drawn. At the end of this experiment, comparative study was made on the flexural behavior of RCC beam by the use of steel fibre with conventional beam, beam with steel fibre on full depth and beam with steel fibre on the half depth(tension zone).

From this investigation, it was observed that the 28 days flexural strength of M30 concrete mix with the usage of steel fibre on beam has higher flexural strength when compared to conventional beam.

It is also observed that, the steel fibre on full depth of beam and steel fibre on tension zone of the beam has almost equal flexural strength. Therefore it is observed that the usage of steel fibre on tension zone is best and economical when compared to steel fibre on full depth, and thus we can reduce the usage of 50% of steel fibre.

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