ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Vol 2, Issue 4, April 2017

To Study Experimental Investigation On The Steel Fibre Reinforced Concrte Deep Beam

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Abstract:- **This case study investigates experimentally the strengthening of reinforced concrete deep beams using steel fibers. The experimental work consists of casting and testing deep beams to show the effect of volume of steel fibers on the behavior of the deep beams on ultimate load, deflection, with constant shear span to depth (a/d) ratios. On the other hand, the effects of these parameters on the behavior and capability of deep beams with variable steel fiber – volume fraction are obtained by using three groups of beams having steel fiber– volume fractions of 0.0%, 0.5%, 1%, 1.5% in deep beams.**

***Keywords*—Deep beam,Steel Fiber,Ultimate load**

I. INTRODUCTION

Beam with large depth in relation to spans are called deep beams. In IS-456(2000) Clause 29, a simply supported beam is classified as deep when the ratio of its effective span L to overall depth D is less than 2. Continuous beams are considered as deep when the ratio L/D is less than 2.5. The effective span is defined as the centre- to-centre distance between the supports or 1.15 times the clear span whichever is less. Despite wide range of reinforced concrete deep beam application in civil engineering project and prolonged research work on this subject,the behaviour of these Member have not been well clarified in various aspect nor well codified foe design engineers and professionals who engage in design of such member in practice .Hence reinforced concrete deep beam investigation and research institutes ,universities or even the companies dealing with reinforced concrete member design in real practice

Some of experimental studies have been done on reinforced concrete deep Beam in Japan and China. some studies have done on shear behaviour of deep beam This study will be carried experimentally and FEM to find the behavior of SFRC of deep beam

II. EXPERIMENTAL PROGRAM

A. Materials Used: The following materials were used for experiment confirming to various standards.

1. Cement:Ordinary portland cement of 53 grade (UltraTech Cement) available in the local market is used in the investigation. The cement used has been tested for various properties as per IS 4031-1988 and found to be conforming to various specifications of IS 12269-1987. The specific gravity is 3.06 and fineness is 2600 cm2/gram.

2. Fine aggregate: Locally available crushed sand was used as fine aggregate which confirms to zone II of IS 383-1983. Coarser sand were preferred, as finer sand increases the water demand of concrete. The specific gravity of fine aggregate is 2.63 and fineness modulus is 3.515.

3. Coarse aggregate: Crushed angular granite metal from a local source was used as coarse aggregate having size ranging from 10mm to 20mm. The specific gravity of coarse aggregate is 2.77, fineness modulus is 7.4 and water absorption is 0.6%.

4.Steel Fiber : Commercially available Steel Fiber from ToughCrete, Nagpur, having the properties as shown in Table 1 is used.

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TABLE 1: PHYSICAL PROPERTIES OF STEEL FIBER

Fiber Type	Low Carbon Cold Drawn Wire
Density	7860 kg/m^3
Length	60mm
Diameter	0.80mm
Aspect Ratio	75
Tensile Strength	>1100Mpa
Compliance	Conforming to ASTM A 820

5. Water: The water used for the study was free of acids, organic matter, suspended solids, alkalis and impurities which when present may have adverse effect on the strength of concrete.

B. Mix Proportion: Concrete mix design in this experiment was designed as per the guidelines specified in I.S. 10262-1982. Mix Proportioning by weight was used and the cement/ dried total aggregates ratio was 1:1.78:2.76. Steel Fiber were added to the Concrete at equal interval of 0.5%, 1%, 1.5% by Volume of Concrete . The mix proportions were calculated and presented in Table 2.

TABLE 2: QUANTITIES OF MATERIALS IN MIX CONCRETE

Materials	(1 M^3 / kg)	Trial batch Weight (kg)
Cements	250	11.75
Fly Ash	80	3.76
10mm	441	20.73
20mm	692	32.52
C sand	871	40.94
Total water	194	9.12
Admixture	2.97	0.140
Steel Fiber 0.5%	12.65	0.594
Steel Fiber 1 %	25.31	1.18
Steel Fiber 1.5%	37.96	1.78

C. Preparation of Test Specimen: In this study, a total number of 8 Beams and added Steel Fiber levels of 0.5%, 1%, 1.5%, were produced respectively. All the mixes were cast using 1:1.78:2.76 mix proportion with constant w/c ratio of 0.45. For the Load Deflection Response strength,700mm x420mm x 150mm Beam Formwork were used to cast the Beam. During Casting of the Beams were used mechanically vibrated. All freshly cast specimens were left in the Formwork for 24 hours before being de-moulded and then submerged in water for curing until the time of testing 7 specimens were tested for 28 age in a particular mix (i.e. the Beams were tested only for 28 days respectively). The specimens were tested for load Deflection Response using a UTM (1000KN) testing machine.

D. Testing Of Specimen: load Deflection Response strength test were carried out at specified 28 ages on the Deep Beam. For the load Deflection Response test, the cubes are placed in machine in such a manner that the Three Point load is applied on the forces perpendicular to the length direction of Beam. In Universal Testing Machine, the top surface of machine is Applying One Point load and Two Point load is applied on the bottomsurface of specimen. The rate of loading is gradual and failure (crushing) load is noted. Also the failure pattern is observed precisely. Figure 1 shows load Deflection Response test setup.

FIGURE 1: ULTIMATE LOAD TEST SETUP

II. RESULTS AND DISCUSSION

A. Results of Ultimate load strength of Deep Beam:

The test was carried out conforming to obtain Flexure strength of M-20 grade of concrete. For Flexure strength testing total 8 Reinforced concrete beam are casted. The Flexure strength of high strength concrete with Steel Fiber ,Opening And Without Opening Deep beam at the age 28 days are presented

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in table 3 There is significant improvement in the strength of Deep beam because of the Steel fiber

a)The Figure illustrates that when the fiber content increases,the ultimate load is significantly increased.The increase in ultimate capacity of attributed to the role of steel fibers in improving the properties of reinforced concrete in resisting additional shear force

b)The Fiber content is increased,the ultimate load also increase this effect may be attributed to the role of steel fiber in improving the properties of reinforced concrete beams with web opening in resisting additional shear force

TABLE 3:EFFECT OF STEEL FIBER OPENING AND WITHOUT OPENING ON ULTIMATE LOAD OF DEEP BEAM

SPECIAMEN	SIZE OF OPENING	ULTIMATE LOAD (KN)	DISPLACEMENT (MM)	FIBER VOLUME FRACTION	LOCATION OF OPENING
B1	Without	336	7.09	0.0%	NA
B2	Without	340	7.12	0.5%	NA
B3	Without	400	8.02	1.0%	NA
B4	Without	488	8.45	1.5%	NA
B5	Opening (75mm)	302	6.97	0.0%	@ L/4 from edge and D/3 from top
B6	Opening (75mm)	310	7.02	0.5%	@ L/4 from edge and D/3 from top
B7	Opening (75mm)	376	7.26	1.5%	@ L/4 from edge and D/3 from top
B8	Opening (75mm)	390	7.84	1.0%	@ L/4 from edge and D/3 from top

IV.CONCLUSION

This Paper presents an experimental program to describe the effect of steel fiber on the behavior of reinforced concrete deep beam with and without web opening.The following conclusion can be drawn from the experimental results

- When the steel fiber volume fraction is increased the ultimate load are increased.
- The increase in steel fiber volume fraction, it decreases the crack pattern.
- Due to high local tensile stresses ‗inclined flexural shear cracks', propagate and reduce the capacity of different possible shear transfer mechanism
- The deflection is decreased as the steel fibre increses
- With opening Deep beam Steel Fiber reduced crack and shear failure.
- Large Opening in beam we should add steel fiber for ultimate load increases and shear Failure reduces

ACKNOWLEDGMENT

In conducting this research, we have received generous help and encouragement from Principal Dr. D. D. Shah, H.O.D. of Civil Engineering Department Dr. A. W. Dhawale. We are also thankful to all faculties and adviser of the Civil Engineering Department for their directly or indirectly involvement in work and our staying in ICOER,Wagholi, Pune.We thank our colleagues who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations of this paper.

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ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
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