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EXPERIMENTAL STUDY OF DOUBLE SKINND CONCRETE FILLED STEELTUBULAR STRUCTURES IN BENDING

Goutam Varma[1], Dr. Pankaj Singh[2], Mayur Singi[3], Kapil Kushwah[4]

[1,3,4]Research Scholar S.R.K. University Civil Engineering
[2]Professor S.R.K. University Civil Engineering

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ABSTRACT - Concrete-filled twofold skin rounded (DSCFST) shafts comprise of two concentric steel tubes; the void between them is loaded up with cement. Favorable circumstances of CFDST over completely concrete filled steel tubes (CFST) incorporate increment in segment modulus, better damping, lighter weight; cyclic stacking. In these paper mechanical properties, for example, Compressive quality shapes and Split rigidity of barrels were tried for M20 grade Concrete. Diverse DSCFST pillars fluctuating internal and external measurements with relating thicknesses were created. Bowing test is performed and contrasted and hypothetical qualities. The shafts are demonstrated great execution in pliable and twisting.

Key words: Double Skin Concrete Filled steel Tubes (DSCFST), Composite Beams, Bending Test, Compressive Strength, Split Tensile Strength.

1. INTRODUCTION

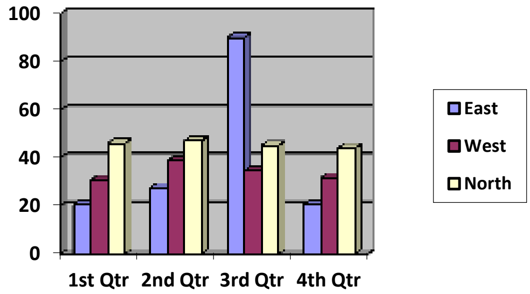
Double Skin Concrete Filled steel Tubes (DSCFST) are composite auxiliary individuals, which comprises of solid which is filled between the voids of inward and external steel tubes. The utilization of cement filled steel tubes (CFST) ends up well known in the previous couple of decades. DSCFST have been utilized in skyscraper wharfs to diminish oneself weight and expansive vitality retention limit against earth shudder stacking. The DSCFST part having empty cross-segment are lighter in weight, contrasted with cement filled steel tubes. In this paper, the trial investigation of twenty four examples of DSCFST bars were tried under two point stacking test technique. Skyscraper composite structures prompt huge development as CFST sections, which bring distinctive financial advantages. Beforehand CFSTs ponders concentrated on joined hub flexural Response or axial. However, recently, CFST elements were used as a main girder of a railway bridge. The behavior of CFST for its flexure has studied experimentally. Experimental work on (DSCFST) members which are subjecting to fire, static loading, cyclic loading and the durability were also studied in the past few years. The changing behavior of sub structural elements due to impact load becomes important because of the increase in accidental impacts. Research work is going on the dynamic response of reinforced concrete and steel structures

2. EXPERIMENTAL STUDY

Compressive strength: The cubes of size 150 mm X 150mm X 150 mm are used for calculating the compressive strength. Concrete cubes were casted with M20 grade of concrete. The compressive strength of cubes for 7, 14, and 28 days were tested. The specimens are tested by compression testing machine. Load should be applied gradually until the specimens fails. Table 1 gives values for compressive strength of cubes. The Compressive strength of cubes Vs Number of days graph has plotted on Figure 1.

Table 1 Compressive strength of cubes

S.No	No. of days	Compressive Strength (N/mm²)
1	7	15.92
2	14	20.24
3	28	24.57



(N/mm2)

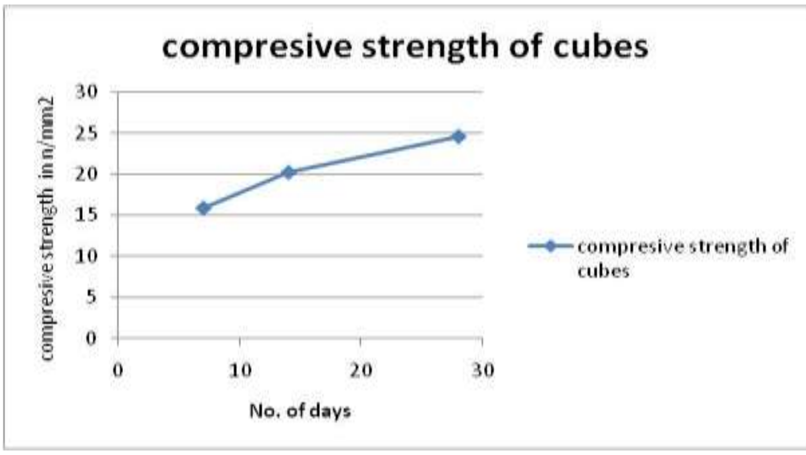


Figure 1 Compressive strength of cubes

2.1. Split tensile strength

The Cylinders of dimensions 300mm X 150mm are used for calculating the split tensile strength. Concrete cylinders were casted with M20 grade of concrete. The split tensile strength of cylinders for 7, 14, and 28 days were tested. The load is applied continuously without slip. Note down the breaking load (P) and the results were tabulated in Table 2. The Split tensile strength of cylinders Vs Number of days

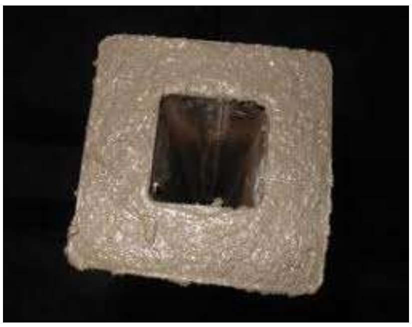
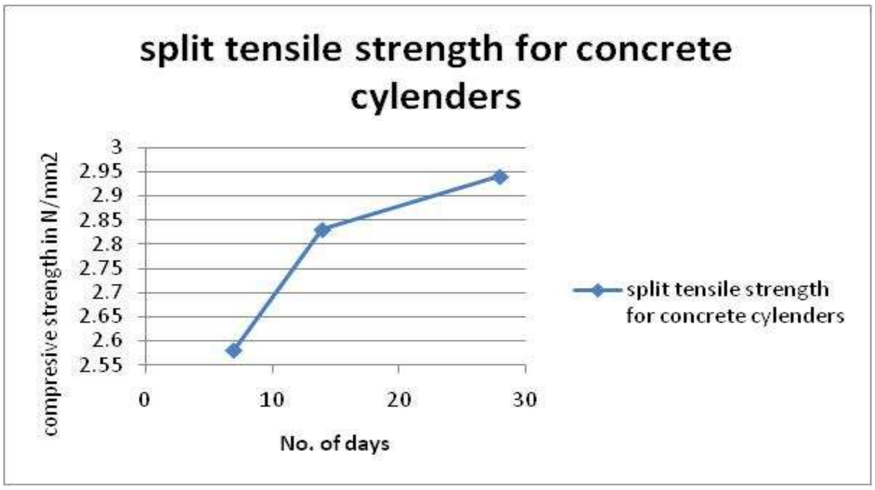


Figure 2

Table 2 Split tensile strength of cylinder

S.No	No. of days	Split tensile strength (N/mm^2)
1	7	2.58
2	14	2.96
3	28	2.94



3. FLEXURAL STRENGTH

3.1. Specimen fabrication

The specimen's outer width varies from 75mm to 150mm and inner width varies from 25mm to 100mm respectively. Both outer and inner steel tubes having thickness varies from 1.2mm to 3mm. A steel plate was welded to one end of the empty steel tube to prevent deterioration of concrete. The beams were casted such that voids between inner and outer steel tubes were filled with concrete. All specimens were cured for room temperature for 28 days. The cross section details of the square DSCFST specimens are listed in Table

Table 3 Cross section details of CFDST beams

S.No	Type of specimen	Bo.o (mm)	To (mm)	Bi.o (mm)	Ti (mm)	Hollow ratio (C)
1	S in S	150	2.5	25	1.2	0.690
2	S in S	150	2.5	50	1.2	0.517
3	S in S	150	2.5	75	2	0.345
4	S in S	150	2.5	100	2	0.172
5	S in S	50	1.2	25	1.2	0.210
6	S in S	75	2	25	1.2	0.260
7	S in S	100	2	25	1.2	0.352
8	S in S	125	3	25	1.2	0.525

S in S - Square in Square

L - Length

Bo.o - Breadth of outer steel tube outer side

Bi.o - Breadth of inner steel tube outer side

To - Thickness of outer tube

Ti - Thickness of inner tube

Hollow ratio = **C** = ____________

4. LOADING FRAME

Beams were tested for a span of 1500mm, which is subjected to two points loading and overhang support distance is maintained at 100mm on both sides. The deflection is noted at a distance of L/3 from each end. Each beam was tested for its maximum load and load Vs mid-span deflection graph is plotted. The beams are attaining its original shape after completing the experimental work due to its ductile nature of steel. The experimental set up for DSCFSTbeam.

5. RESULTS AND DISCUSSIONS

The Experimental and theoretical results are tabulated below and the graphs are drawn below.
The experimental results are tabulated below in Table 4.

Table 4 Dimensions of beams with maximum load and maximum deflection

S.No	Beam size (mm x mm)	Thickness of outer steel (mm)	Thickness of inner steel (mm)	Hollow ratio (C)	B_i / B_0	Max load (kN)	Ave. Max Load (kN)	Max deflection (L/2) (mm)	Ave. Max deflection (L/2) (mm)	Max deflection (L/3) (mm)	Ave. Max deflection (L/3) (mm)
1	150 X 100	2.5	2	0.690	0.67	256	255.67	8.11	8.92	7.25	8.35
2						249		5.49		9.43	
3						262		9.22		9	
4	150 X 75	2.5	2	0.517	0.50	226	227.33	8.7	8.80	7.5	7.81
5						230		9.2		8.04	
6						226		9.65		8.8	
7	150 X 50	2.5	1.2	0.345	0.33	230	215.00	7.99	7.82	6.4	6.52
8						205		7.77		7.78	
9						210		7.7		6.17	
10	125 X 25	3	1.2	0.210	0.20	160	160.33	12.06	9.66	10.1	8.07
11						164		7.1		8.7	
12						157		8.21		7	
13	100 X 25	2	1.2	0.260	0.25	98	81.00	15.55	15.48	13.25	13.02
14						80		8.2		15.6	
15						65		15.3		12.4	
16	75 X 25	2	1.2	0.352	0.33	32	29.33	17.21	16.81	15.2	14.78
17						25		7.2		16.23	
18						31		17		14.99	

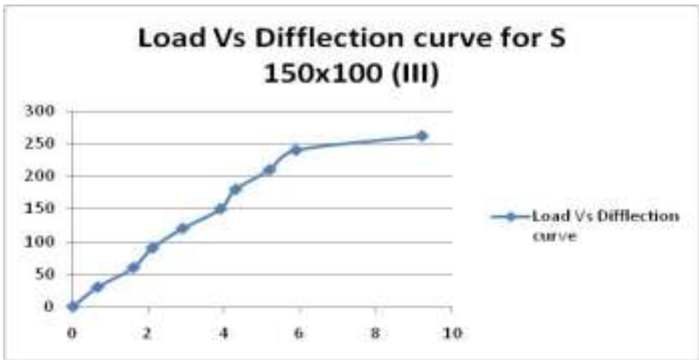
The comparison of Experimental maximum load and Theoretical maximum load is shown in Table 5

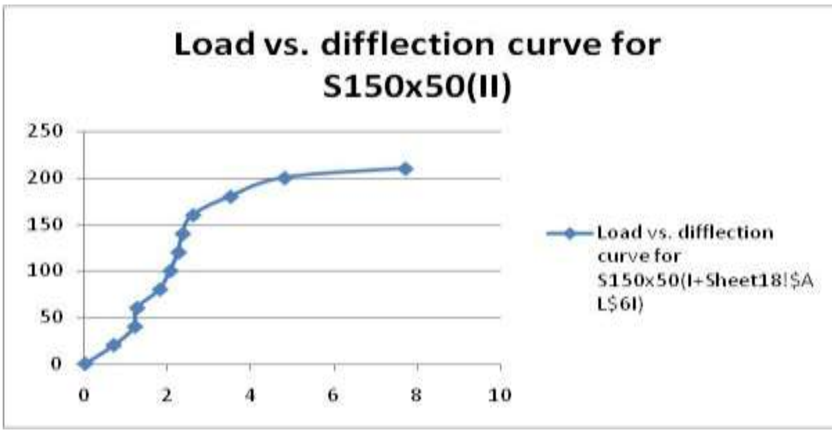
Table 5 Comparison of results for experimental and theoretical values

S.No	Size of beam	Theoretical value (kN)	Experimental value (kN)	Ratio (Exp/The)
1	150 X 100	174.96	255.67	1.461305
2	150 X 75	166.82	227.33	1.362726
3	150 X 50	162.54	215.00	1.322751
5	125 X 25	102.21	160.33	1.568633
6	100 X 25	36.67	81.00	2.20889
7	75 X 25	14.39	29.33	2.038221

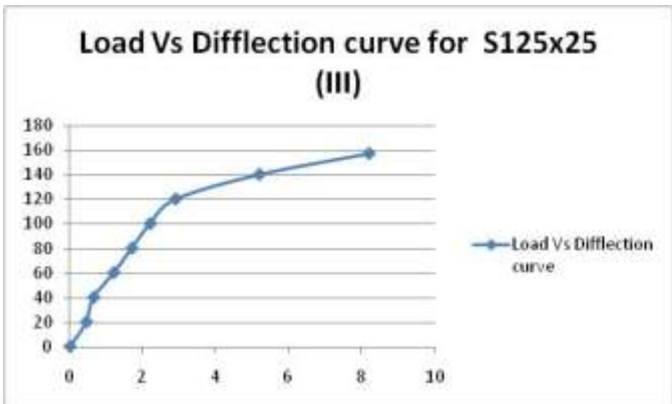
6. LOAD VS. DEFLECTION

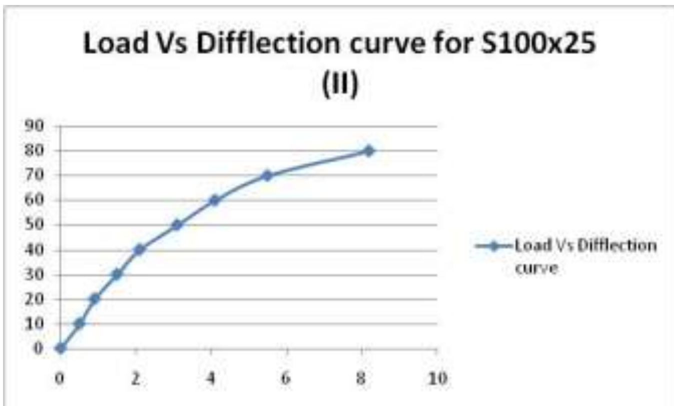
The beam of outer steel tube 150mm and varying inner steel tube dimensions (100mm, 75mm, 50mm,) has gets increasing in maximum load respectively. The Load Vs Deflection graph for DSCFST beams of outer tube 150mm and varying inner tube (100mm, 75mm, 50mm) is shown in Figure

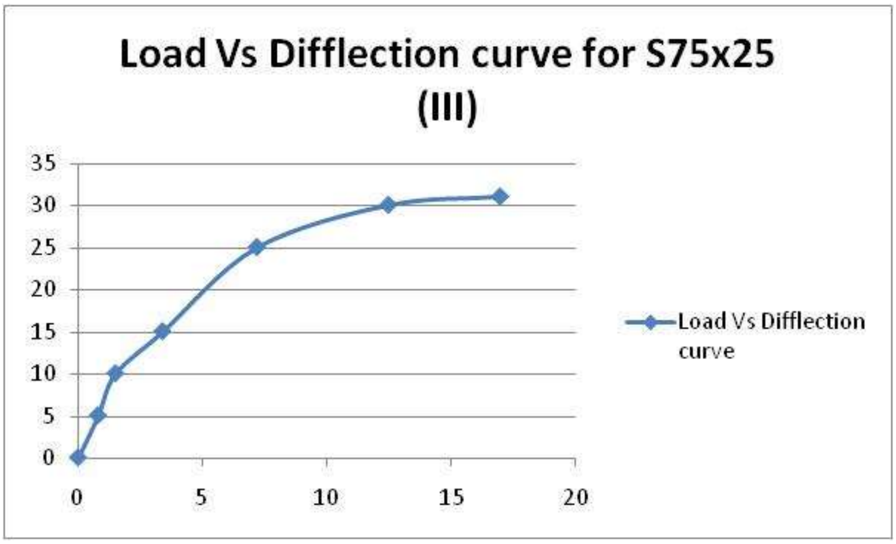




The Load Vs Deflection graph for DSCFST beams of inner tube 25mm and varying outer tube (125mm, 100mm, 75mm) is shown in Figure below.







CONCLUSIONS

Concrete filled double skin tubular beams were subjected to bending under two points loading, following conclusions had been drawn.

1. A series of experimental tests on square DSCFST subjected to Flexure test. Enhancement in strength has been observed for DSCFST beams (square in square) due to the ductile nature of steel and Composite action between steel and concrete.

2. The flexural strength of DSCFST beams increases with respect to the increase in the dimensions of inner tube, by keeping the outer steel tube dimension as constant and changing the inner steel tube dimensions.

3. The DSCFST beam 150 x 100mm has attained more bending strength than 150 x 50mm beam.

4. The bending strength of DSCFST beams is increased with respect to the increase in the dimension of outer tube, by keeping the inner steel tube dimension as constant and changing the outer steel tube dimensions.

5. The beam of inner steel tube 25mm and having outer steel tube of increasing dimensions (75mm, 100mm, and 125mm) has gets increasing in deflection.

The beams of outer steel tube 150mm and having inner steel tube of increasing dimensions (100mm, 75mm, 50,) has gets increasing in maximum load.

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