Studies on Brick and RCC Composite Beams

Piyush Kumar[1] Mr. R.D. Patel[2]
[1]PG Scholar [2]Associate Professor
[1,2]Department of Civil Engineering
[1,2]M.M.M.U.T. Gorakhpur, India

Abstract— The main objective of this thesis is to study replacement of concrete by bricks. In reinforced concrete beams strength of concrete lying the neutral axis [just above and below] is not fully utilized. So near the neutral axis as well in tension zone concrete has been replaced by bricks in order to reduced weight and cost of beams. An experimental program is conducted on six simply supported concrete beams. All six beams cast in 2 different groups and every group having 3 beams. The first group of beams is of reinforced concrete beams and second group of beams are composite beams. Both groups of beam compare with each other. The deflection readings are taken with the help of dial gauges. The dial gauge are at position L/6, L/3, L/2, 2L/3 and 5L/6, where L is the length of beam. The relationship between load and mid-span deflection are being drawn.

Key words: RCC Beams, Brick Beams, Flexural Strength, Reinforced Masonry

I. INTRODUCTION

A structural member composed of two or more dissimilar materials joined together to act as a unit in which the resulting system is stronger than the sum of its parts. Examples are sandwich beams, reinforced concrete beams and bimetallic beams. In reinforced beams, less stressed concrete near the neutral axis and tension zone can be replaced by bricks to reduce the weight of the structure and also achieve the economy..

The behaviour of reinforced brickwork is almost similar to that of reinforced concrete and current design method for reinforced brickwork is based on the principle of elastic design of reinforced concrete.

A reinforced concrete beams should be able to resist tensile, compressive and shear stresses induced in it by loads on beam. Concrete is fairly strong in compression but very weak in tension. Thus the tensile weakness of concrete is overcome by provision of reinforced steel in the tension zone around the concrete to make a reinforced concrete beams.

In this study partially utilized concrete of RCC beam have been replaced by bricks in order to reduce the weight of beams and also achieve economy, and by reducing concrete we have to save cement and by saving cement reduced the greenhouse gasses emissions. So it is environment friendly.

II. EXPERIMENTAL STUDY

Total six numbers of reinforced concrete beams were cast for the experimental study. All the six beams were cast in two different group of three beam in each group. The first group of beams is the control group in which three reinforced concrete beams were cast. The second group of beams is the composite beams in which three brick and reinforced concrete composite beams were cast. This two different groups are compared with each other.

Fig. 1: Arrangement of Bricks with Reinforcement Cage

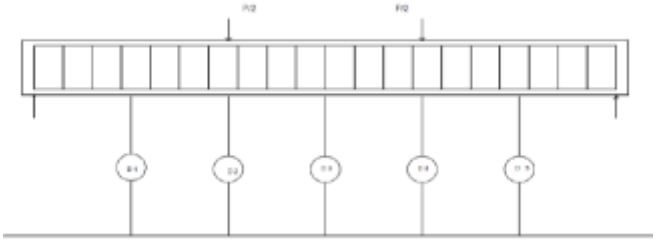

Fig. 2: Position of Dial Gauge

III. CASTING OF SPECIMEN

For conducting experiment, six reinforced concrete beam specimen of sizes as shown in the figure effective length leff = 2.4m, breadth of beam b =0.23m, depth of beam d = 0.25m. The mix proportion used is for water, cement, fine aggregate and course aggregate is taken. The mixing is done by hand mixing. The beam cured for 28 days.

Fig. 3: Reinforcement Cage for Composite Beams

Fig. 4: Casting of Beam

IV. EXPERIMENTAL SET UP

The beams were tested in the loading frame of "Structural Engineering "Laboratory of Madan Mohan Malaviya University of Technology, Gorakhpur". The testing procedure for all the specimen is same. First the beams are cured for a period of 28 days then its surface is cleaned with the help of sand paper for cleared visibility of cracks. The two point loading arrangement was used for testing of beams. This has the advantage of substantial region of uniform bending, the two point loading system is provided is being showed in figure. The load is transfer through load cell on to the spreader I beam. The spreader I beam is installed on rollers seated on desired point of beam loading was done by hydraulic jack of capacity 100KN.

Fig. 5: Beam on Testing Frame

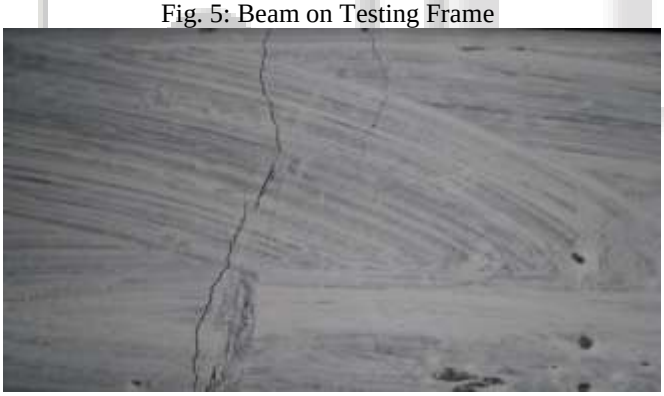

Fig. 6: Crack in Tension Zone Propagates in Upward Direction

Fig. 7: Failure of Beam at Ultimate Load

LOAD (KN)	DEFLECTION (mm) BEAM B-1	DEFLECTION (mm) BEAM B-2
0	0	0
5	0.06	0.13
10	0.18	0.52
15	0.35	0.95
20	0.65	1.37
25	1.02	1.85
30	1.47	2.33
35	1.90	2.87
40	2.38	3.44
45	2.97	4.10
50	3.48	4.72
55	4.19	5.40
60	4.72	6.23
65	5.46	7.12
70	6.12	7.92
75	6.76	9.29
80	7.48	10.44
85	8.25	11.65
90	9.45	

Table 1: Relation between load and deflection for group of RCC beam and group of composite beams

V. EXPERIMENTAL RESULT

Their behaviour throughout the test is described using recorded data on flexure behaviour and the ultimate load carrying capacity. The crack pattern and the mode of failure of each beam are also described in this chapter. All the beams are tested for their ultimate strength. Beam B-1 is taken as the control beam (RCC beams) it is observed that control beam had more flexure strength than the composite beams.

Failure modes have been observed in the experiment of rectangular RCC beams and composite beams. Load was applied at the L/3 and 2L/3 and at each increment of the load , deflection at L/6 , L/3 , L/2 , 2L/3 and 5L/6 is taken with the help of dial gauges.

The loading arrangement is same for all beams. Here the deflection of each beam is analysed. Deflection of composite beam is compared with the deflection of control beam. Since the loading arrangement is same for all beams so the crack pattern deflection behaviour and failure analysis is done by comparing the group beams of B-2.

A. Comparison between RCC group beam b-1 (control group) and composite group beam b-2

As seen below the load deflection curve shows the curve between the RCC beam (control beam) B-1 and composite group beam B-2. In this curve we observe that beam group B-2 have little bit more deflection as compared to control group beam B-1 and also ultimate load of both group of beam have not more difference. So group beam B-2 has desired strength as group B-1 but its deflection is more.

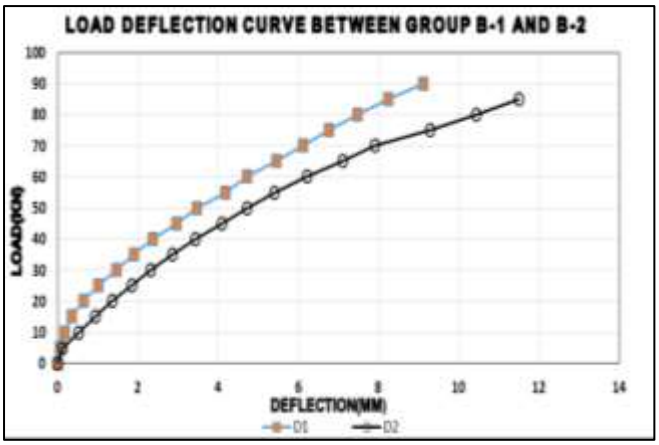

Fig. 8: the load deflection curve shows the curve between the RCC beam (control beam) B-1 and composite group beam B-2

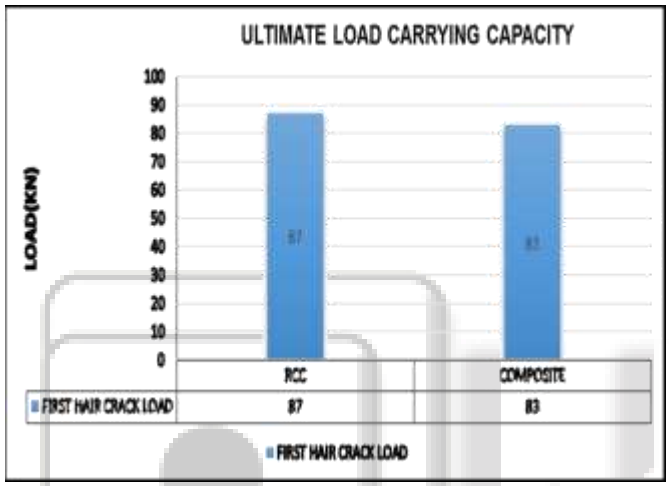

Fig. 9: Ultimate Load Carrying Capacity

This shows the load carrying capacity of the control beams and composite beams. It has been observed that RCC group beams B-1 has greater load carrying capacity as compared with composite group beams B-2.

VI. Conclusion

All the beams of composite shows large deflection with respect to the RCC beam.

Control beams shows a little bit more ultimate load as compare to composite beams. So group beam B-2 has desired strength as group B-1.

It has been observed that RCC group beams B-1 has more first hair crack strength as compared with composite group beams B-2.

Presence of bricks in tension zone has not caused significant reduction in strength of brick and RCC composite beams.

Behaviour of composite beams is similar to that of reinforced concrete beams.

By reducing concrete we have to save cement and by saving cement reduced the greenhouse gases emissions. So it is environment friendly.

Reference

[1] Hand Book of Masonry Design and Construction SP 20 (S&T):1991

[2] Brick filled reinforced concrete composite beams by method of Initial Function (By PATHAK K.K., DUBEY S.K., and Department of Civil Engineering. Maulana Azad National Institute of Technology, Bhopal).

[3] Concrete Mix Design, Dr. M. C. NATARAJA Professor of Civil Engineering, Sri Jayachamarajendra College of Engineering, Mysore-570 006

[4] Flexural and shear strength of reinforced perforated clay brick masonry members (beams) By (EHAB M. LATFY, HUSSAN MOHAMADIEN, HUSSEIN MAKHTAR HASSAN)

[5] Design Aids For Reinforced Concrete IS 456-1978 Bureau of Indian Standard.

[6] Hand Book of Masonry Design and Construction SP 20 (S&T):1991

