IJSTE - International Journal of Science Technology & Engineering | Volume 2 | Issue 2 | August 2015
ISSN (online): 2349-784X

Studies on RCC and Brick Composite Slabs

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Abstract

The main objective of this thesis is to study replacement of concrete by bricks. In reinforced concrete slabs strength of concrete lying the neutral axis [just above and below] is not fully utilized. So near the neutral axis as well as in tension zone concrete has been replaced by bricks in order to reduced weight and cost of slabs.An experimental program is conducted on six simply supported concrete slabs. All six slabs cast in two different groups and every group having three slabs. The first group of slabs are of reinforced concrete slabs and second group of slabs are of brick composite slabs. Both groups of slabs compare with each other.The deflection (in mm) readings are taken with the help of dial gauges. The dial gauges are at position of 300mm far from centre of the slab on the right hand and 300mm far from the centre of the slab on the left hand on both side and one dial gauge is placed at the centre of the slab. The total no. of dial gauges are used throughout the study is five (5).The relationship between load and mid-span deflection are being drawn.

Keywords: RCC, Brick, Flexural strength, Deflection, Cracks, Dial gauges

I. INTRODUCTION

A structural member composed of two or more dissimilar materials joined together to act as a unit and the resulting system is stronger than the sum of its parts. Examples are concrete and steel slabs, bamboo is used with concrete to making slabs and bimetallic slabs. In reinforced slabs, less stressed concrete near the neutral axis and tension zone, it 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 slabs should be able to resist tensile, compressive stresses induced in it by loads on slabs. 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 slabs.

In this study partially utilized concrete of RCC slab have been replaced by bricks in order to reduce the weight of slabs and also achieve economy, and by reducing concrete we have to save cement and by saving cement reduced the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

II. EXPERIMENTAL STUDY

Total six numbers of reinforced concrete slabs and Brick Composite slabs were casted for the experimental study. All six slabs were casted in two different groups of three slabs in each group. The first group of slabs is consisting three reinforced concrete slabs. The second group of slabs is consisting three brick composite slabs. These two different groups are compared with each other based on the some various parameters.

Fig. 1: Arrangement of Bricks with Reinforcement Cage

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III. CASTING OF SLAB SPECIMEN

For conducting experiment , six reinforced concrete slab specimen of sizes as shown in the figure effective span, l_{eff} = 2.076m , breadth of slab b = 1 m, Overall depth of slab d = 0.1 m, Effective depth d_{eff} =.076m. The mix proportion used is for water, cement, fine aggregate and course aggregate is taken. The mixing is done by manual mixing. The slabs cured for 28 days.

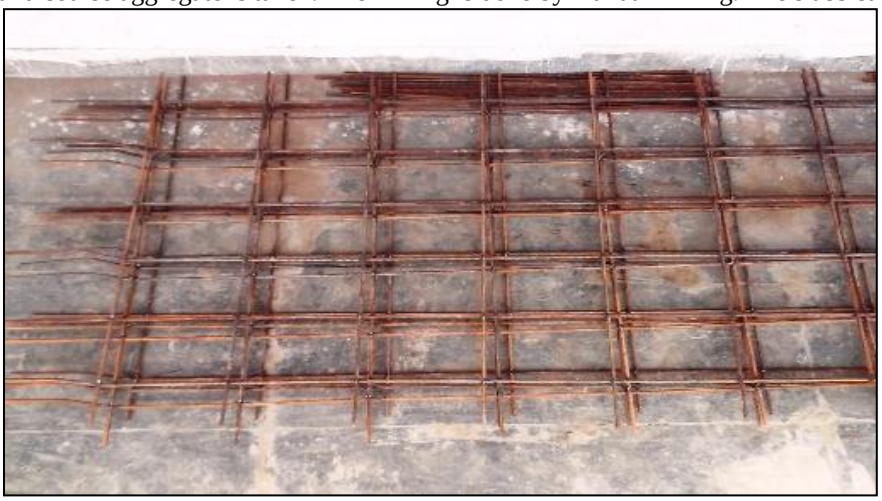

Fig. 2: Reinforcement Cage for Slabs

Fig. 3: Casting of Slabs

IV. EXPERIMENTAL SET UP

The slabs were tested at the loading frame in "Structural Engineering "Laboratory of Madan Mohan Malaviya University of Technology, Gorakhpur". The testing procedure for the entire specimen was same. First the slabs were cured for a period of 28 days then its surface is cleaned with the help of sand paper for cleared visibility of cracks. The four point loading arrangement was used for testing of slabs. It has the advantage of substantial region of uniform bending, the four point loading system is provided and it 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 slab loading was done by hydraulic jack of capacity 100KN.

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Fig. 4: Slab on Testing Frame

Fig. 5: Crack in Tension Zone Propagates in Upward Direction

Fig. 6: Failure of Slab at Ultimate Load

Table – 1
Relation between load and deflection for group of RCC slabs and group of Brick Composite slabs

LOAD (kN)	*DEFLECTION (mm) SLAB RS*	*DEFLECTION (mm) SLAB CS*
0	*0.000*	*0.000*
5	*0.394*	*0.570*
10	*0.972*	*1.170*
15	*2.044*	*2.654*

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20	*5.410*	*5.898*
25	*8.768*	*9.928*
30	*11.386*	*12.590*
35	*16.878*	*17.575*
40	*20.214*	*21.352*
45	*21.380*	*22.230*
50	*22.484*	*24.465*

V. EXPERIMENTAL RESULT

The behaviour of slabs 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 slab are also described in this study. All the slabs are tested for their ultimate strength. Slab RS is taken as the control slab (RCC slabs) it is observed that control slabs had more flexure strength than the composite slabs.

Failure modes have been observed in the experiment of rectangular RCC slabs and brick composite slabs. Load was applied at the 300 mm here and there of centre of slab at each increment of the load, deflection is also measure where load was applied, with the help of dial gauges.

The loading arrangement is same for all slabs. Here the deflection of each slab is analysed. Deflection of composite slab is compared with the deflection of control slab. Since the loading arrangement is same for all slabs so the crack pattern deflection behaviour and failure analysis is done by comparing the group slabs of CS.

A. Comparison between rcc group slab rs (control group) and composit group slab cs

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

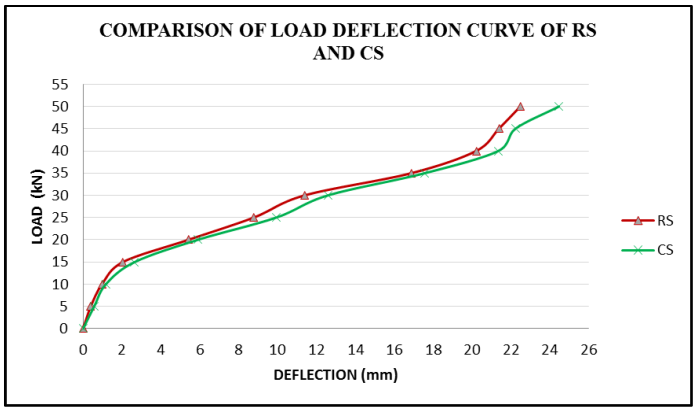

Fig. 7

B. Ultimate Load Carrying Capacity:

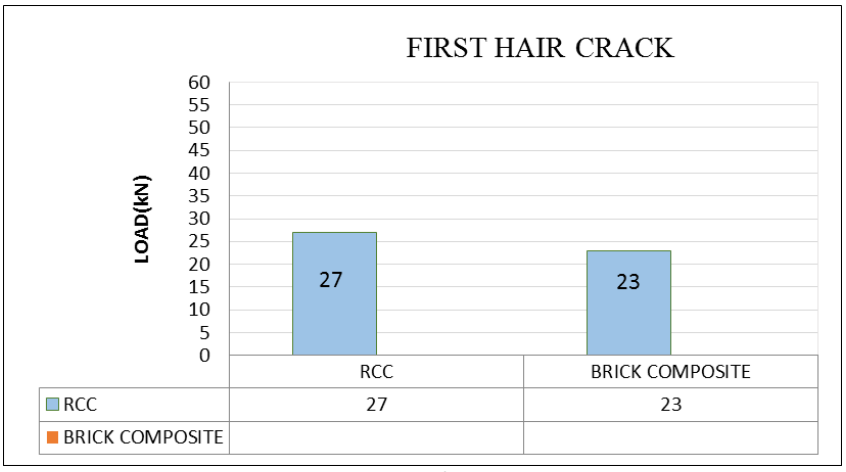

Fig. 8

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This shows the load carrying capacity of the control slabs and composite slabs. It has been observed that RCC group slabs RS has greater load carrying capacity as compared with composite group slabs CS.

VI. CONCLUSION

All composite slabs shows large deflection with respect to the RCC slabs.

Control slabs shows a little bit more ultimate load as compare to composite slabs. So group slab CS has desired strength as group slab RS.

It has been observed that RCC group slabs RS has more first hair crack strength as compared with composite group slab CS.

Presence of bricks in tension zone has not caused significant reduction in strength of brick and RCC composite slabs. Behaviour of composite slabs is similar to that of reinforced concrete slabs.

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

1) Four points loading shows the nonlinear load displacement curve after first crack is observed.
2) No major difference in deflection of both types of slabs so we can say the performance of the both slabs near about same.
3) In both slabs we observed first crack at load between 25 kN to 30 kN.
4) In Brick Composite slabs required less quantity of concrete as compared to RCC slabs so, it is less costly slab.
5) Brick Composite slabs have less weight than RCC slabs.

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