|| Volume 2 ||Issue 1 ||AUG 2017||ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

# A Study on Economic Beam Section by Placing Light Weight Material below Neutral Axis

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***Abstract*— With increasing demand and consumption of cement, researchers use the various waste materials to replace the concrete. As the part above neutral axis is in compressive and the part below neutral axis is in tension in case when a beam subjected to sagging moment and vice a versa if a beam subjected to hogging moment. So the concrete below neutral axis can be replaced by any materials. There are various materials which can be replace the concrete in tension zone. There are various materials that we can use such as bricks, clc blocks, wooden blocks etc. The materials should be such that the bond between the materials and steel should be strong enough same as between the steel and concrete. This type of beams are used anywhere but for small sections the casting of this sections is difficult and time consuming. After using lightweight materials the dead weight of section is reduced by 16%. The cost of the section is also reduced by 9%. Behaviour of reinforced concrete infilled beams is similar to that of reinforced concrete beams. Presence of lightweight materials in the low stressed zone has not caused significant reduction in strength of reinforced concrete beams. During this project work no of beam having dimension (1100x150x300)mm for different infilled material tested to compare the various properties and cost analysis with conventional beam.**

***Keywords***— Cellular Lightweight Concrete Blocks, Brick, Wooden block.

## I INTRODUCTION

Reinforced concrete is being used in most of construction activities. In recent days the problem faced by the construction industry is acute shortage of raw materials. Researchers have been investigating many alternative materials to suite the Indian scenario. Rice husk, saw dust, light weight aggregates, copper slag, fly ash, are some of the materials experimented. In the beams the concrete below the neutral axis does not take any tension. Hence the replacement of this concrete can reduce the materials used for construction that physical conditions are verified for infilled beam. brick filled RC composite beams. A newly developed lightweight reinforced concrete (LSRC) section has been experimentally investigated section can be used either as beams or slabs. The section is made up of a reinforced concrete with lightweight block infill. LSRC developed LSRC members are suitable for large span construction due to the weight saving benefits and ease of construction. Sustainability means meeting the needs of the present generation without compromising the ability of future generations to meet their needs. Experimental work is carried on the brick filled reinforced concrete beams, with the view that the stresses in the beams are maximum at the top and bottom and zero at the neutral axis. So a cheap and light material can be used near the neutral zone for light weight and economy. Behaviour of brick infilled reinforced concrete beams under cyclic loading is find out experimentally and compared the results with the conventional reinforced concrete beam. It is observed that the load carrying capacity of an infilled beam was about 80% of the conventional reinforced concrete beams. Experimental study of brick filled reinforced concrete beam is done and it is observed that saving of about 30% concrete is achieved. The analytical and experimental investigations on infilled frames under static and lateral loads are conducted and suggested that the load carrying capacity and stiffness of the infill frame is more than the plain frame. The experimental programme is conducted on the beams with light weight brick core.

***Table 1 Tabular Form of Specimen to be Casted***

| Sr. no | Description | Number | Length | Breadth | Depth |
|---|---|---|---|---|---|
| 1 | Conventional | 2 | 1100mm | 150 mm | 300 mm |
| 2 | Brick infilled beam | 2 | 1100 mm | 150 mm | 300 mm |
| 3 | CLC infilled beam | 2 | 1100 mm | 150 mm | 300mm |
| 4 | Wooden infilled | 2 | 1100 mm | 150 mm | 300 mm |

**Table 2 Comparison of shear strength of beams**

| Sr. No | Description | Strength(KN) | Mean Strength(KN) |
|---|---|---|---|
| 1 | Conventional Beam | 272.200 | 256.6 |
| | | 214.850 | |
| 2 | Brick Infilled Beam | 247.650 | 244.50 |
| | | 241.360 | |
| 3 | CLC Infilled Beam | 261.800 | 254.27 |
| | | 246.750 | |
| 4 | Wooden Infilled Beam | 259.800 | 242.32 |
| | | 224.850 | |

## II TEST RESULTS AND DISCUSSION

A number of beam were casted with given dimension and various infilled material in tension zone. Different test carried out after 28 days curing on UTM.

**Shear Strength of Beam Sections:**

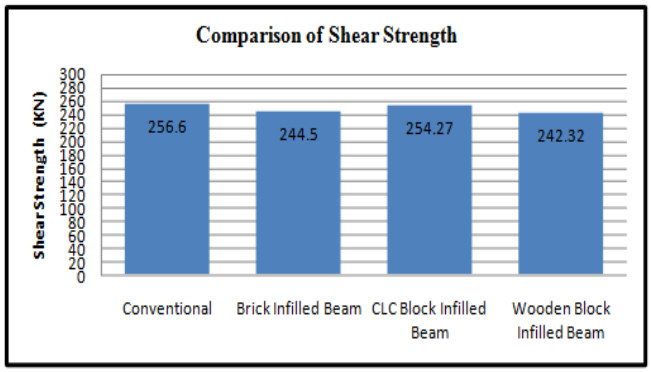


*Figure 1 Comparison of shear strength of beams*

*Table 3 Ultimate Moment of Beam Sections*

| Sr. No | Description | Ult. Moment (KN-m) | Mean Ult. Moment (KN-m) |
|---|---|---|---|
| 1 | Conventional Beam | 54.45 | 48.685 |
| | | 42.90 | |
| 2 | Brick Infilled Beam | 49.15 | 48.68 |
| | | 48.21 | |
| 3 | CLC Infilled Beam | 50.360 | 49.50 |
| | | 48.650 | |
| 4 | Wooden Infilled Beam | 51.96 | 48.38 |
| | | 44.80 | |

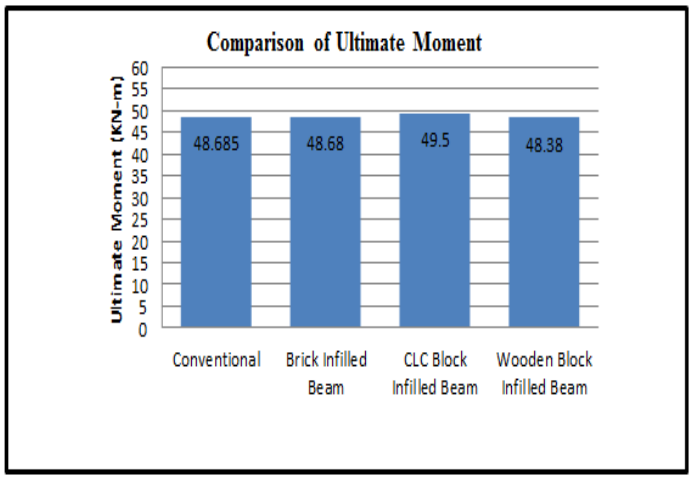


*Figure 2 Comparison between ultimate strength of beam sections*

*Table 4 Deflection of Beam Sections*

| Sr.No | Description | Deflection (mm) | Mean Deflection(mm) |
|---|---|---|---|
| 1 | Conventional Beam | 7.02 | 5.83 |
| | | 4.64 | |
| 2 | Brick Infilled Beam | 5.51 | 5.33 |
| | | 5.16 | |
| 3 | CLC Infilled Beam | 6.24 | 5.59 |
| | | 4.95 | |
| 4 | Wooden Infilled Beam | 6.03 | 5.51 |
| | | 5.00 | |

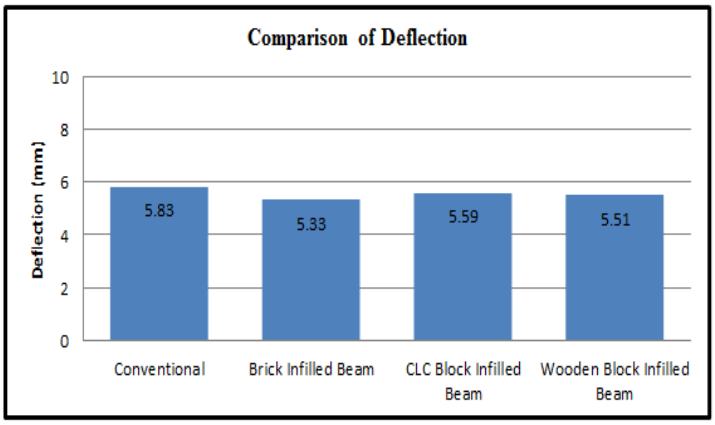


*Figure 3 Comparison of deflection of various sections of beams*

*Table 5 Costs of Beam Sections*

| Sr.No | Description | Cost in rupees per beam |
|---|---|---|
| 1 | Conventional Beam | 187.4 |
| 2 | Brick Infilled Beam | 180.03 |
| 3 | CLC Infilled Beam | 179.62 |
| 4 | Wooden Infilled Beam | 179.4 |

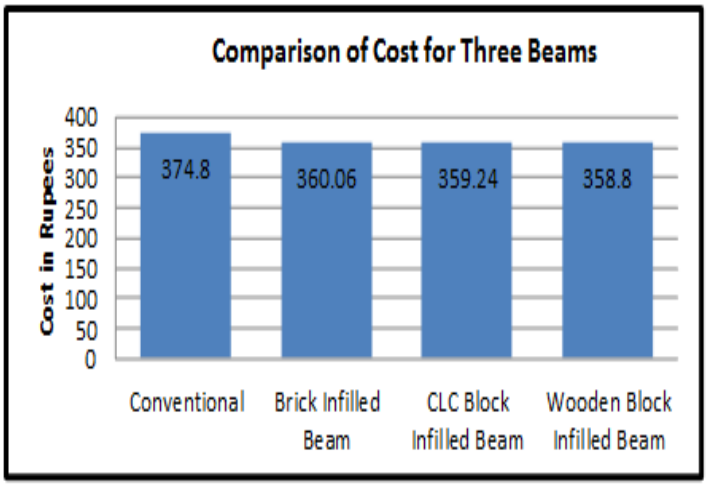


*Figure 4 cost comparison of beam sections*

*Table 6 Weight of Beam Sections*

| Sr. No | Description | Weight in KN | Weight in Kg |
|---|---|---|---|
| 1 | Conventional | 1.18 | 120.28 |
| 2 | Brick infilled beam | 1.13 | 116.05 |
| 3 | CLC block infilled beam | 0.99 | 100.9 |
| 4 | Wooden block infilled beam | 0.94 | 95.87 |

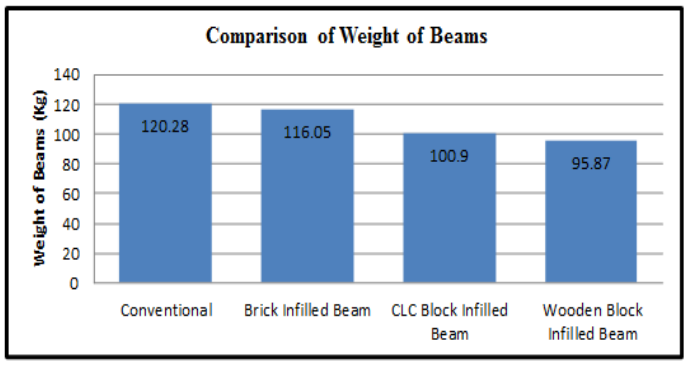


*Figure 5 Comparison of weight of beam section*

## III CONCLUSION

1. Behavior of reinforced concrete infilled beams is similar to that of reinforced concrete beams.
2. Presence of lightweight material in the low stressed zone has not caused significant reduction in strength of reinforced concrete beams. It has been observed that the replacement of concrete by lightweight material in reinforced concrete beams does not require any extra labor or time.
3. Economy and reduction of weight in beams depends on the percentage replacement of concrete by lightweight materials.
4. The shear strength of infilled beam is more than design shear strength.
5. The ultimate moment carrying capacity of infilled beam is not affected by large difference compare to conventional beam.
6. The infilled material can sustain more deflection.
7. The cost of infilled beams is less than conventional beams. So it can be practically used.
8. The weight of the structure is reduced due to lightweight material. So the overall weight of the structure is reduced.

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