International Journal of Innovative Research in Science and Engineering
Vol. No.3, Issue 03, March 2017
www.ijirse.com
ISSN (O) 2454-9665
ISSN (P) 2454-0663

STUDY OF FLEXURAL STRENGTH OF BEAM-SECTION REPLACING LIGHT WEIGHT MATERIAL BELOW NEUTRAL AXIS

Gorde Ajay Jagannath[1], More Nitin Rajendra[2], RaundaleVivek Hemant[3], Sharma Shubham Sunil[4], Shewale Ganesh Sanjay[5]

[1,2,3,4,5]*Student, Civil Engg. Dept., Sanghavi College of Engg., Nashik, Savitribai Phule Pune University, (India)*

ABSTRACT

This project mainly aims at reducing the total dead load or self weight of beam to increase the efficiency of the beam. In RC (reinforced concrete) beams strength of concrete lying near the neutral axis is not fully utilized. The concrete just above the neutral axis less stressed whereas the concrete below the neutral axis serves as a shear transmitting media. Partially utilized concrete of RC beam has been replaced by light weight material. In this way, the economy of reinforced light weight material beams and strength of RC beams are tried to be combined in light weight material filled beams. There are few research papers related to replacing the concreteby materials like CLC blocks, PVC, Wood etc.

This Paper includes behavior of light weight material 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 light weight material filled reinforced concrete beam is done and it is observed that saving of about 30% concrete is achieved.

Keywords*:*Light Weight Materials, Neutral Axis.

I. INTRODUCTION

1.1Nature of the problem-

This concept is not related to cure any major problems during construction, but this paper is about to bring an improvement and to increase efficiency of the beam structure.Now-a-days concrete with varieties of strength are available as per requirements. Cost of concrete too varies with strength. In this study, therefore an attempt has been to study the effect on conventional sections when the portion below neutral axis is replaced by any infill material such as bricks, CLC blocks etc. As the stresses at top is compressive and at bottom is tensile so a cheap material can be used near neutral axis.

1.2 Previous work-

There are few research papers related to replacing the concrete by materials like CLC blocks, PVC, Wood etc. The result and conclusions of these researches differ according to type and strength of concrete, size of specimen used, volume replaced by light weight material.

International Journal of Innovative Research in Science and Engineering
Vol. No.3, Issue 03, March 2017
www.ijirse.com
ISSN (O) 2454-9665
ISSN (P) 2454-0663

1.3 Purpose-

1.3.1 To reduce volume of concrete.

1.3.2 To replace concrete volume by cheap lightweight material.

1.3.3 To achieve required or sufficient strength considering factor of safety.

1.3.4 To reduce expenditure in total volume of construction.

1.3.5 To get efficient structure due to the achieved strength and reduced cost of structure.

1.3.6 To control rate of hydration.

1.4 Contribution of this Paper-

This Paper includes behavior of light weight material 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 light weight material filled reinforced concrete beam is done and it is observed that saving of about 30% of concrete volume is achieved.

1.5 Stepwise Procedure to Place the light weight material at specific correct location in beam before concreting-

A) Find out the depth of neutral axis (Xu) from top using formula,

$$Xu^1 = (0.87fy*Ast) / (0.36fck*B)$$

B) Subtract the depth of neutral axis (Xu) from the whole depth of beam (D+d')

$$\text{i.e. } D - (Xu+d')$$

C) This will be the depth for placing the light weight material below the neutral axis.

D) Place the material at the location as shown in fig.

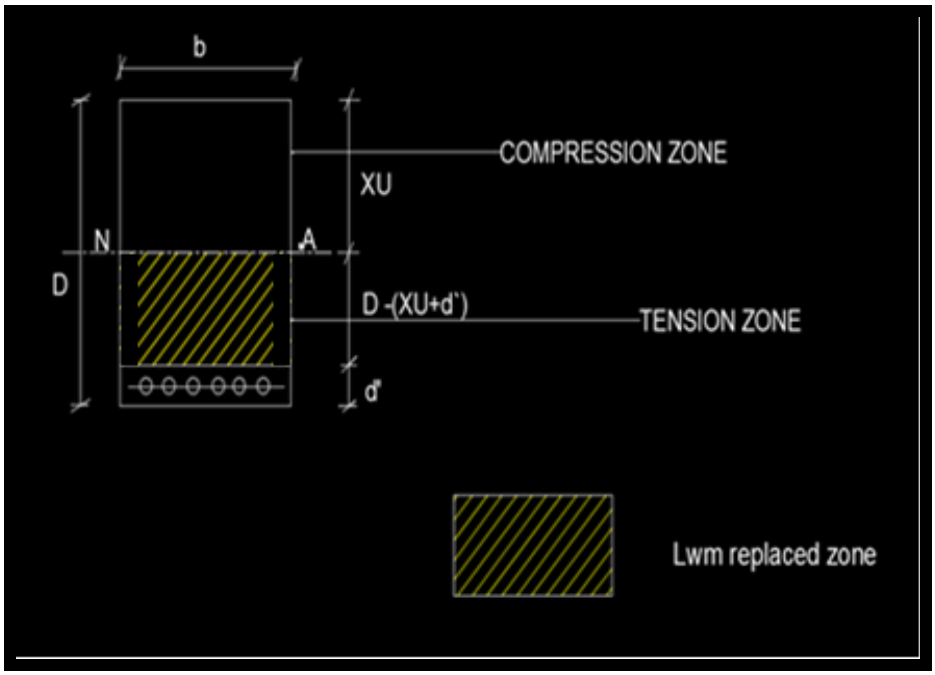


Fig. 1.5.1 Location for LWM in a Beam

E) Keep sufficient side cover.

F) Finally go for usual concreting.

International Journal of Innovative Research in Science and Engineering
Vol. No.3, Issue 03, March 2017
www.ijirse.com
ISSN (O) 2454-9665
ISSN (P) 2454-0663

II. MATERIALS USED FOR REPLACING CONCRETE-

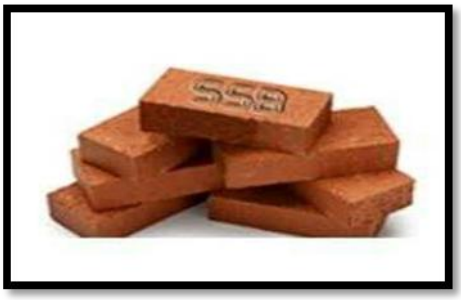
We have chosen three materials to replace the concrete as light weight material :

2.1Burnt Red Bricks, 2.2AAC Blocks, 2.3MurrumInfilled Plastic Bottles

We will see some important properties of above materials regarding our requirements:

2.1 Burnt Red Bricks

Bricks remain one of the most important building materials in the country. Brick making is a traditional industry in India, generally confined to rural areas. In recent years, with expanding urbanization and increasing demand for construction materials, brick kilns have to grow to meet the demand. So we can say burnt red brick is one of cheap, easily available material, & also we can use broken pieces of bricks which makes this option more cheaper than its prime cost.



Photograph 2.1.1 Burnt Red Bricks

Some important properties of brick are mentioned and simultaneously compared with concrete-

Table2.1.1 Specifications of bricks

Parameters	Clay Bricks	Concrete
Block Density ($kg/m^{3)}$	1900	2400
Compressive Strength (kg/cm^2)	40-75	Differs
Thermal conductivity (W/m.k)	0.184	0.5
Water Absorption (%)	20%	Differs
Drying Shrinkage (mm/m)	No Shrinkage	Differs

2.2 AAC(Autoclaved Aerated Concrete) Blocks-

Photograph2.2.2 AAC Blocks

ISSN (O) 2454-9665
ISSN (P) 2454-0663

Now-a-days widely used in India and also available almost everywhere. It is a better option instead using burnt bricks for construction as it is less dense and eco-friendly material. It is agood insulator of thermal and electrical conductivity having other properties as follow:

Table 2.2.2 Specifications Of AAC Blocks

Parameters	AAC Blocks	Concrete
Block Density (kg/m$^{3)}$	600	2400
Compressive Strength (kg/cm^2)	40	Differs
Thermal conductivity (W/m.k)	0.132 – 0.151	0.5
Water Absorption (%)	45%	Differs
Drying Shrinkage (mm/m)	0.011 – 0.058	Differs

3) MurrumInfilled Plastic Bottles -

This is not a Factory made material. Common Murrum is filled in number of plastic bottles and then these bottles are compressed to get required volume while placing in a beams as shown in Photograph.2.3.1

Phpotograph.2.3.1

It have some dramatic properties as it is a combination of plastic and murrum such as follow:

Table 2.3.1 Specifications OfMurrumInfilled Plastic Bottles

Parameters	MurrumInfilled Plastic Bottles	Concrete
Block Density (kg/m$^{3)}$	1400 (for Murrum)	2400
Compressive Strength (kg/cm^2)	Differs	Differs
Thermal conductivity (W/m.k)	No Effect	0.5
Water Absorption (%)	No Water Absorption	Differs
Drying Shrinkage (mm/m)	No Shrinkage	Differs

III.TEST PROGRAMME

The beams were tested for flexural strength after curing for 7 days, 14 days and 28 days on a universal testing machine, the deflection in the beam is noted at regular intervals from the deflection dial gauge and the load at the point of failure is noted. The bearing surfaces of the supporting & loading rollers are wiped clean, and any

ISSN (O) 2454-9665
ISSN (P) 2454-0663

loose sand or other material removed from the surfaces of the specimen where, The specimen is then placed in the machine in such a manner that the load is applied to the uppermost surface as cast in the mould, along two lines spaced 20cm apart .The axis of the specimen is carefully aligned with the axis of the loading device.

No packing is used between the bearing surfaces of the specimen and the rollers. The load is applied without shock and increasing continuously at a rate such that the extreme fiber stress increases at a approximately 0.7Kg/cm2 /min. Load is increased until the specimen falls, the maximum applied to the specimen during the test is recorded. The appearance of the fractured faces of concrete and any unusual features in the type of failure is noted. The flexural strength of the specimen is expressed as modulus of rupture fb which if 'a' equals the distance between the line of fracture and the nearer support, measured on the center line of the tensile side of the specimen, in cm, is calculated to the nearest 0.05 MPa as follows:

The flexural strength when a > 13.3cm for a 10cm specimen, $fb = Pa/bd^2$

The flexural strength when a < 13.3cm for 10cm specimen, $fb = 3Pa/bd^2$

Where,

b = Measure width of specimen in mm

d =Measure depth in mm of the specimen at the point of failure.

a= Distance of crack from the nearer support in mm

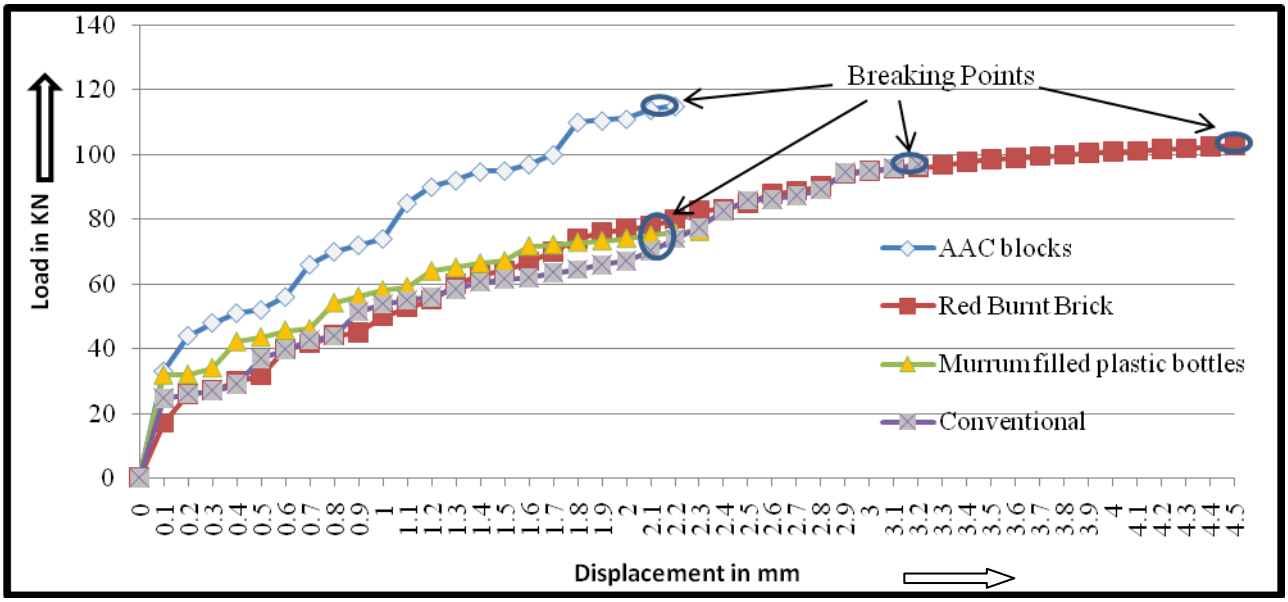
P = Maximum load in N applied to the specimen.

Flexural strength is expressed in N / mm^2.

IV. TEST RESULT -

Results From UTM are represented in the form of graphical representation of load against displacement as follow:

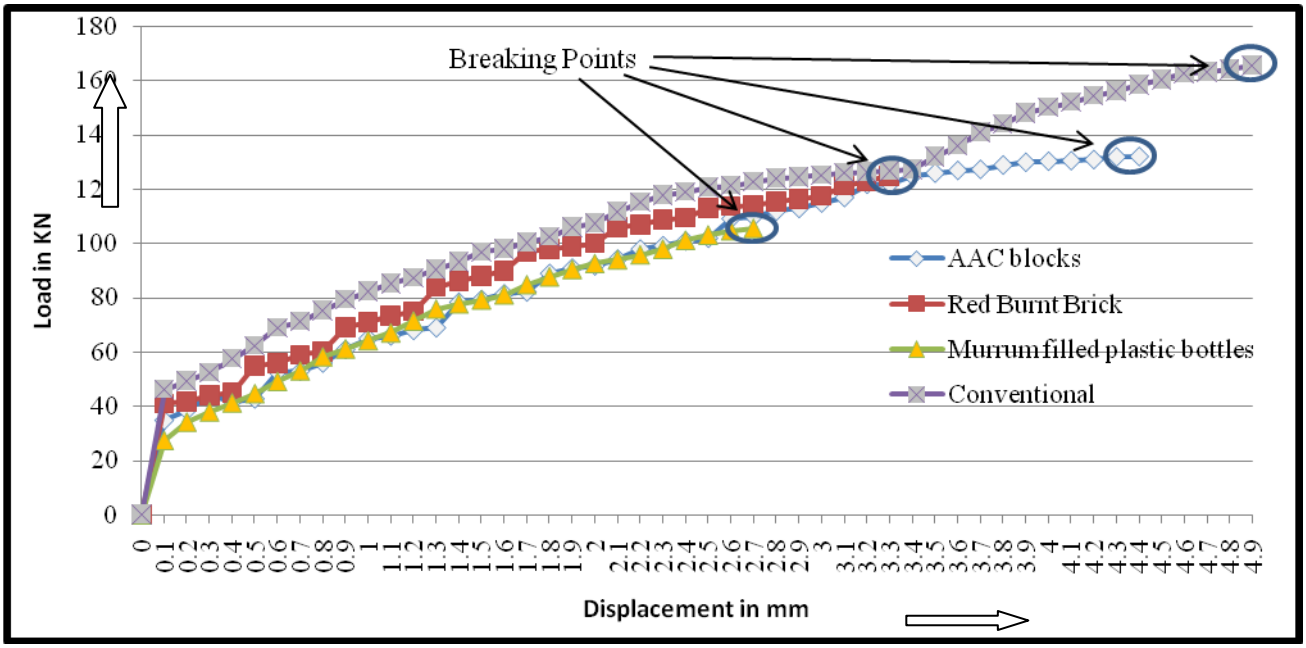
4.1 Result of Specimen cured for 7 days-



Graph. 4.1.1 Result of specimen cured For 7 Days

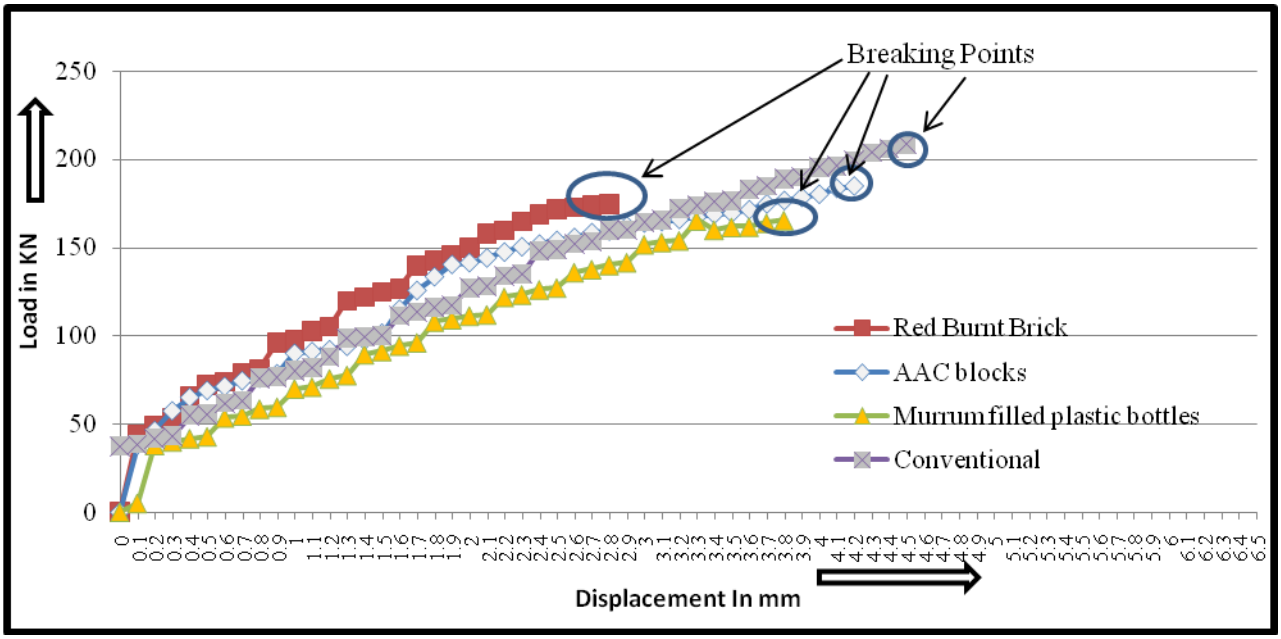
International Journal of Innovative Research in Science and Engineering
Vol. No.3, Issue 03, March 2017
www.ijirse.com
ISSN (O) 2454-9665
ISSN (P) 2454-0663

4.2 Result of Specimen Cured For 14 Days



Graph.4.2.1 Result Of Specimen For 14Days

4.3Result of Specimen for 28 Days-



Graph. 4.3.1 Result Of Specimen For 28 Days

V. CONCLUSION

After replacing of light weight material below neutral axis, 30% of volume of concrete get reduced. After experimental investigation it is observed that, after 28 days of curing, conventional concrete has flexural strength 8.05 N/mm², while on the same day AAC block has flexural strength 8.16 N/mm² & that of beam

ISSN (O) 2454-9665
ISSN (P) 2454-0663

casted by replacing concrete with murrum in filled bottles has flexural strength 6.65 N/mm² & beam casted by replacing concrete with burnt red bricks has flexural strength 6.5 N/mm². From observation, we conclude that, we should prefer AAC block as a replacing material below neutral axis, as it have more flexural strength than the flexural strength of conventionally casted beams.

VI. RESULT

As AAC block has flexural strength 101.36% of flexural strength of conventionally casted concrete beam i.e. 8.16N/mm², prefer AAC block as light weight material to replace the concrete in concrete beams below the neutral axis.

VII. ACKNOWLEDGEMENT

It gives us great pleasure in presenting the paper for preliminary project on,'STUDY OF FLEXURAL STRENGTH OF BEAM SECTION REPLACING LIGHT WEIGHT MATERIAL BELOW NEUTRAL AXIS.' We would like to take this opportunity to thank our internal guide Prof. S. D. Nagare for giving us all the help and guidance we needed. We really grateful to them for their kind support and their valuable suggestions were very helpful. We are also thankful to Prof .S.W .Manjarwal, HOD of Civil Dept., Sanghavi College of Engg.For his indispensable support, suggestions. At next our special gratitude to Prof .N. S. Shewale, Prof. P.B. **Shinde, and Prof. T.A.Kulkarni** (GGCOERC) for providing various useful information & Laboratory facilities for us. We are thankful for Samrat group of construction for providing us support by sponsoring our project

REFERENCES

[1.] W.GodwinJesudhason, Dr. G. Hemalatha, 'Experimental Investigation On Beams Partial Replacement Below The Neutral Axis', Researchgate, vol. no. 5 April 2014. , 567-898.

[2.] Jain Joy, Rajesh Rajeev, 'Effect of Reinforced Concrete Beam with Hollow Neutral Axis', IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 10, 2014 | ISSN (online): 2321-0613.

[3.] Patel Rakesh, Dubey S. K, Pathak K.K, 'Brick Filled Reinforced Concrete Composite Beams' , International Journal of Advanced Engineering Technology E-ISSN 0976-3945.(2013).

[4.] S. B. Kandekar, P. D. Dhake , M. R. Wakchaure, 'Concrete Grade Variation In Tension And Compression Zones Of Rcc Beams', International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 8, August 2013.

[5.] Deepak Gowda. , Dr. H. B. Balakrishna, 'Experimental Study On Flexural Behavior Of Reinforced Concrete Beams By Replacing Copper Slag As Fine Aggregate', International Journal of Civil and Structural Engineering Research Vol. 2, Issue 1, pp: (97-103), Month: April 2012.

[6.] Arivalagan Soundararajan1, KandasamyShanmugasundaram, 'Flexural Behaviour Of Concrete-Filled Steel Hollow Sections Beams', 14:2, 107-114.(2010).

[7.] Gupta M. and Pandey A.K., 'Experimental studies on brick masonry in compression', Indian Concrete Journal, Vol.86 (1), pp. 43-50, (2012).

ISSN (O) 2454-9665
ISSN (P) 2454-0663

[8.] Arulselvan S., K. Subramanian, PillaiP. E. B. and Santhakumar A.R., 'RC Infilled frame- RC plane frame interactions for seismic resistance', Journal of Applied sciences Vol.7(7) pp. 942-959,(2007).

[9.] A 'Permanent ferrocement forms: A viable alternative for construction of concrete beams', 30th global Conference in concrete & structures, Singapore, (2005).

[10.] Dubey S.K., 'Analysis of homogeneous orthotropic deep beams'. Journal of Structural Engineering, Vol. 32(2), pp.109-166, (2005).Ezzat H.F, Mohamed N. A., Yousry B. S. and Ahmed

[11.] Dubey S.K., 'Analysis of composite laminated deep beams'. Proceedings of the third International Conference on 'Advances in Composites', ADCOMP, Bangalore, pp.30-39, (2000).

[12.] Choubey U.B. and Gupta U, 'structural response of brick-filled reinforced concrete beams', Proceedings of fourth International seminar on Structural masonry for developing Countries,Madras,pp. 226-233, (1992).

[13.] Govindan, P. and Santhakumar A. R., 'Composite action of reinforced cement concrete beams with plain masonry infills', Proceedings of International Symposium on Reinforced and Prestressed Masonry, Edinburgh, (1984).

IyengarK. T. S Raja, and P. V. Raman, 'Free vibration of rectangular beams of arbitrary depth', ActaMechanica, Vol.32 (1), pp. 249-259, (1979).

[14.] 'Brick filled reinforced concrete composite beams'from Patel Rakesh,Dubey S. K,pathakk.k.