Effect of Masonary Infill on Compressive Strength of Rapid Wall

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Abstract— The purpose of the present study is to investigate the compressive strength of Glass fiber reinforced gypsum (GFRG) hollow panel with concrete hollow panel and also ascertain the compressive strength by filling hollow portion with brick bats and recycled aggregates with cement slurry. Hollow concrete block was designed with proper surface finish using M20 mix. A comparative study of compressive strength parameters was tested with respect to GFRP panel to concrete panel with different materials. The result showed that GFRG panel exhibits better compressive strength than concrete panel.

Index Terms— GFRP, Compressive strength. Hollow concrete block, Brick bats, Recycled aggregates. Gypsum, Cement slurry.

I. INTRODUCTION

Sustainable improvement in the construction industry, normally understood in the public opinion, e.g. the recycling of waste and the installation of energy maintaining equipment in the homes. Concrete is the main material of construct and the ease or cost of its production accounts for the level of success in the area of environmental upgrading involving the construction of new roads, buildings, dams, water structures and the renovation of such structures. To produce the concrete primary components such as cement, sand, gravel and some admixtures are to be present in varying quantities and qualities [3]. Rapid wall affords fast track building construction method with the aid of utilizing the advantages of prefabricated, light weight large panels with modular Cavities [1]. Hollow concrete block is an essential addition to the sorts of masonry units available to the developers and its use for masonry a constant will increases, some of the benefits of hollow concrete block construction are reduced mortar consumption, light weight and greater velocity of masonry work compared with brick masonry. Geopolymers were developed initially to serve as a fire resistant material, now it has gained momentum as an alternate to the cementations binders particularly with a low carbon footprint [7].

Since builders are yet to become familiar with the use of hollow concrete blocks, this will assist them to appreciate the essential constructional details and adopt hollow concrete block masonry in a massive scale wherever it is far low cast [2]. Concrete hollow blocks were used for masonry wall, because of their light weight and better insulation of sound and heat. Rapid wall generation is an innovation of Australia and is proving to be of awesome benefit in modern housing scarcity and rapid environmental degradation. It is an alternative technology used for creation of buildings with usage of rapid walls that are all additionally known as gypcrete panels or GFRG panels (Glass Fibre reinforced Gypsum). These rapid wall panels are made up of gypsum which can also either be naturally taking place or may be huge amount of waste from the fertilizer enterprise. In India, FACT and RCF, two most important fertilizer manufacturing factories have taken the initial steps in introducing this technique and have set up rapid wall and plaster manufacturing factories under the name of objectives. Geopolymer has the potential to reduce greenhouse emissions by 80%.[5].

GFRG wall is a green product which can erect a building fast in prefabricated method, but its application to high-rise residential buildings is limited for its poor lateral stiffness. Modification of GFRG walls structure to increase its lateral stiffness, which aiming to erect small high-rise residential buildings as load-bearing by reinforcing the GFRG by brickbats and recycled aggregates [7]. The load carrying capacity of masonry wall with steel fibre reinforced hollow block was greater than that with locally available solid and hollow block by 12% and 22% respectively [8]. Figure 1 depicts the rapid wall.

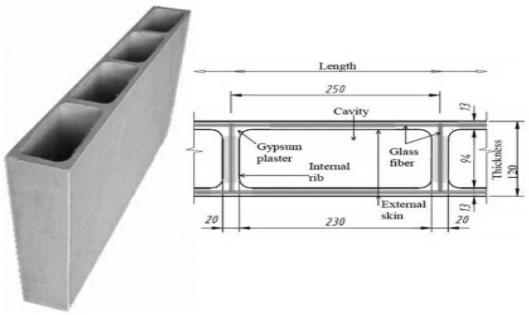

Fig 1. Rapid wall

II. MATERIALS AND METHODOLOGY

2.1 Materials used in present work

Cement: In this investigation, cement , which were having normal consistency of 32% and specific gravity of 3.1 and initial setting time of 38 min and final setting time of 540 min this cement fallows according to IS:8112-1989

Gypsum: Main raw material (96.5%) is recycled /calcined industrial by product waste gypsum which is abundantly available in India.

Fine aggregate: In this investigation, the river sand , which were having specific gravity of 2.64 used and sieve analysis showed that was it belongs Zone II and follows according as per IS:383-1970.

Coarse aggregate: Locally available crushed coarse aggregate of passing through 10mm and retaining on 4.75 mm size used and water absorption of CA was 0.6% and follows according as per IS:383-1970 1970 with the specific gravity of 2.59

Brick bat: used are burnt clay bricks. These brick bats are free from building rubbish and organic decomposed material and brick bat used are 20mm down size.

Fiber glass: 30 Kg of fiber is used to manufacture 1 panel of 12 x 3 x 0.124 M. This is used as reinforcing agent.

Chemical additives: Silicon based polymer is used to prevent the absorption of water from atmosphere.

Setting aid: Resonant agents are used to improve the workability and to improve the setting time.

Plaster: 1.4 to 1.5 ton of plaster is used to cast one panel of size12 x 3 x 0.124 M

Water: In the present investigation, potable water was used as said IS 456-2000 for the plain cement concrete. 5.5 to 6.2% of water was used for the plaster while casting the panel.

2.2 Methodology:

This project is a study of compressive strength of GFRP hallow panel with concrete hallow panel. And also ascertain the compressive strength of by filling hollow portion with brick bats and recycled aggregates with cement slurry. Hollow concrete block was designed with proper surface finish using M20 mix. GFRP panels were casted on the manufacturing unit. The dimension of the specimen was 320 x 300 x 124 mm and dimension of cavity was 250 x 230 x 90 mm. figure 2 depicts the GFRP hallow block

Fig 2: Hallow block

These specimens were tested in the compression testing machine. A panels were tested for 7 days and then by knowing the load carrying of capacity of a single panel. It was noted that the strength of the hollow block is increased significantly when it was made solid by filling the hollow portion by brickbats, cement slurry and putting mortar inside the hollow portion by recycled aggregates, which is easily available. The bearing surfaces of the compression testing machine are wiped clean and any dry loose or other materials are removed. The dimensions of the hollow blocks are measured and their weighs are noted before testing. The two surfaces of each block that would normally be placed horizontally in the wall are termed as faces. The load is applied in these bed faces. The axis of the bed face is carefully aligned with the centre of spherically seated plate. No packing is used between the faces of the test specimen and the steel plate of the testing machine. The load is applied without shock and increased continuously at a rate of approximately 140 kg/sq.cm/min until the resistance of hollow concrete blocks to the increasing load breaks down and greater load can be sustained. The maximum load in kilograms supported by the block before failure on square centimeter will be taken as the compressive strength of the block. The mean of the compressive strength of the three blocks will be taken as the compressive strength of batch compressive strength less than 75% of the mean value so obtained.

Fig 3. Blocks during test

Fig 4. GFRP hallow panel filled with recycled aggregates

III. RESULT AND DISCUSSION

In this investigation, to study the compressive strength of GFRP hallow panel with concrete hallow panel. The hollow concrete blocks were tested in the compression testing machine. Table 1 depicts the compressive strength of GFRP panel with different material. A number of blocks were tested for 7 days and then by knowing the load carrying of capacity of a single unit.

Table 1: Compressive strength of concrete panel with different material.

GFRP panel with different material	compressive strength (kg/cm²)
GFRP panel with empty	36.35
Panel with brick bat and cement slurry	47.94
Panel with recycled aggregate	53.89

Fig 5. Shows the compressive strength of GFRP hallow panel. The compressive strength of GFRP panel is found to be 15.9% and 32.54% compared to GFRP panel filled with recycled brickbat and GFRP panel filled with recycled aggregates

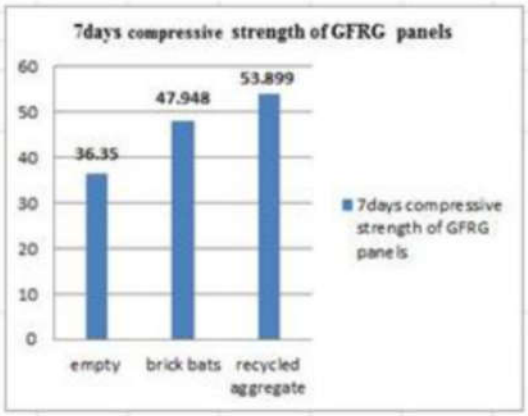

Fig 5. Compressive strength of GFRP panel

Table 2 depicts the compressive strength of concrete panel with different material. A number of blocks were tested for 7 days and then by knowing the load carrying of capacity of a single unit.

Table 2. Compressive strength of concrete panel with different material.

Concrete panel with different material	compressive strength (kg/cm²)
Concrete panel with empty	26.33
Panel with brick bat and cement slurry	39.53
Panel with recycled aggregate	47.94

Graph 2 shows the compressive strength of concrete hallow panel. The compressive strength of concrete panel is found to be 17.55% and 45% compared to concrete panel filled with recycled brickbat and recycled aggregate.

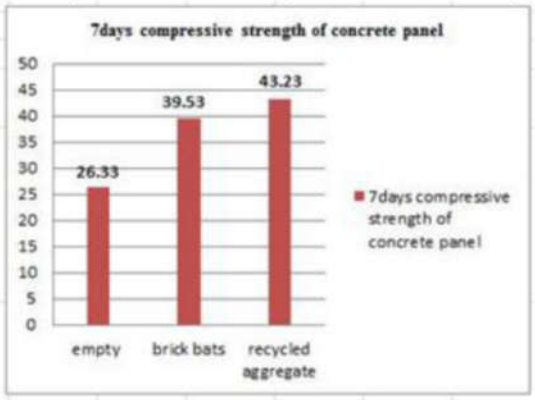

Fig 6. Compressive strength of concrete panel

IV. CONCLUSIONS

It has been observed that GFRP Panel with cavity exhibits 38.08% higher compressive strength than concrete panel of hallow cavity. GFRP panel with hallow cavity filled with brickbat exhibits 10.79% higher compressive strength than concrete panel of hallow panel of hallow cavity filled with brickbat. GFRP Panel with hallow cavity filled with recycled aggregates exhibits 36.34% higher compressive strength than concrete panel of hallow cavity filled with recycled aggregates. The result from this work has demonstrated that glass fibers are can be considered as potential reinforcing material and GFRP panels' exhibits better compressive strength than concrete panel.

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REFERENCES

[1] Suhas Tayade, Navnath Shinde, Sachin Patil, Study of an Efficient Building Material: Rapid Wall, International Journalof Modern Trends in Engineering and Research, ISSN No.:2349-9745, July 2015

[2] Mr. M K Maroliya. Load Carrying Capacity of Hollow Concrete Block Masonry Column. IOSR Journal of Engineering, ISSN: 2250-3021, Volume 2, October 2012

[3] P. N. Onuamah and N. N. Osadabe, Development of optimized strength model of lateritic hollow block with 4% mound soil inclusion, Nigerian Journal of Technology, Vol. 34 No. 1, January 2015, pp. 1 – 11

[4] R.R.Sorate and Alka Dhiman, Slum Rehabilitation with Fast Track Techniques. IOSR Journal of Mechanical and Civil Engineering, ISSN: 2278-1684, Volume 11, Jun. 2014, pp 27-32.

[5] P.M.Vijaysankar, R. Anuradha, V.Sreevidya, Dr. R. Venkatasubramani. Durability Studies of Geopolymer Concrete Solid Blocks, International Journal of Advanced Scientific and Technical Research Issue 3 volume 2, March-April 2013 ISSN 2249-9954

[6] V. Revathi, J. Thaarrini, M. Venkob Rao, A Prospective Study on Alkali Activated Bottom Ash-GGBS Blend in Paver Blocks, International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering Vol:8, No:3, 2014

[7] Zhengyong Liu, Huiqing Ying, Elastic Lateral Features of a New Glass Fiber Reinforced Gypsum Wall, International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering Vol:4, No:3, 2010

[8] Sarath P, Pradeep P, Shemy S. Babu, Experimental Investigation on the Performance of Interlocking Concrete Hollow Block Strengthened With Steel Fibres, International Journal for Research in Applied Science & Engineering Technology, Volume 3, October 2015, ISSN: 2321-9653

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