

A Review on Modern Construction Using GFRG Panels

Nitin. F. Shavari¹ Sunil. S. Marathe² Akshay. R. Bailmare³ Tejas. D. Jagtap⁴ Prof. Pravin. M. Thorat⁵

^{1,2,3,4}B.E. Student ⁵Head Of Department

^{1,2,3,4,5}Department of Civil Engineering

^{1,2,3,4,5}SRTTC – FOE (Khamshet), India

Abstract— GFRG panel is a revolutionary low-cost, load bearing prefabricated walling system with broad construction applications for all types of buildings. The single panel wall system serves as both the internal and external wall and eliminates the need for bricks, blocks, timber and steel wall frames and plasterboard linings. This means that building with GFRG wall panel significantly reduces the number of trades required on site, speeding up construction time and reducing cost.

Keywords: GFRG, Low-Cost, Time, Flexible

I. INTRODUCTION

GFRG panel is a cost effective prefabricated load-bearing, single panel, walling system with significant benefits for the building industry, especially in the speed of construction. Manufactured to precise specifications the panels are cut in the factory and delivered on-site ready for erection. It is also known as rapid wall panel.

Unlike other systems GFRG wall can be erected by a small crew of trained manual workers thereby reducing the need for traditional building skills.

GFRG wall panels can be used for numerous wall construction applications. They can be used anywhere traditional construction methods would be used, replacing, brick, block, concrete, steel framed systems and other prefabricated panels. They are suitable for any type of building from domestic housing, commercial and industrial buildings to multi-storey. The use and properties of the panel change depending on the material with which the cavities are filled. Standard fills include insulation, concrete and sand. A non-filled, insulation or sand filled panel can be used for non-load bearing walls or load bearing walls in single or in certain cases double storey construction but have different properties. Concrete filled panels are load bearing. The engineering design will determine how the cavities should be filled.

The GFRG panel measures 12.02 m long by 3 m high. The panels are cellular in form. The cavities extend to the full height of the panel which has an overall thickness of 123 mm plus or minus 3 mm

The panel has an inner and outer leaf of 13mm thick plus or minus 3mm, with cavities 94 mm deep by 230 mm wide separated by a 20 mm wide web.

MATERIAL REQUIRED FOR MANUFACTURING OF PANEL (12.05M X 0.125M X 3.0 M)

Sr no.	Ingredients/Materials	Quantity
1	Stucco	1390KG
2	Glass Fiber	30KG
3	Water Resisting Agent	53.5KG
4	Distemping Agent	2.1KG
5	Crystals Habit Modifiers	128GMS
6	Retarder	110-540 GMS

7	Water	856KG
---	-------	-------

II. LITERATURE REVIEW

- 1) Devdas Menon et al. [2014] discussed a construction of building made in IIT Madras. The building is constructed victimization of GFRG Panels that have made out of mineral, mostly accessible in style of phosphogypsum, a waste by-product of fertilizer trade and glass fiber as a reinforcing agent, which boosts the strength of the panels. The building panels are appropriate for reasonable mass housing, with the benefits of value effectiveness and fast construction.
- 2) Eldhose M Manjummekudiyil, Basil P Alias, Biji K Eldhose, Sarath Rajan, Thasneem Hussain et al. [2015] studied regarding GFRG Panel strengthening victimization of very different concrete mixes crammed within the cavities. They used three very different concrete mixtures within the panels for testing. The concrete is a Nominal mix M25, Fly ash concrete and Recycled Aggregate concrete. The main objective of victimization ash in most of the cement concrete applications is to urge sturdy concrete at a reduced value. The addition of fly ash as additional ingredients at the concrete mixing stage as part replacement of OPC and fine aggregates is a method that is more flexible.
- 3) Aishwary Shukla, Mohd. Afaque Khan et al. [2016] researched on wall panel building system. This paper surveys about advancements in the field of building frameworks utilizing glass fiber strengthened gypsum boards. GFRG boards, made in institutionalized parts or segments prepared for quick gathering and erection as structures are instant gypsum boards with empty depressions.
- 4) Meselhy Elsaed et al. [2016] Studies about the GFRG framework and configuration cost model to examine coordinate expense for the framework amid the planning stage. The market cost for this framework is separated into two fundamental perspectives; cost and increase. The increase viewpoint is separated into the possibility, which is principally identified with hazard investigation and it contrasts regarding the site, proprietor and venture.
- 5) Sk. Subhan Alisha et al. [2016] discovered gypsum is a tough material, and it is as of now vigorously being used as parcel dividers. Specialists foresee that a building made of GFRG boards can have a life expectancy of 60 years. A GFRG building does not require the United Nations Framework Convention on Climate Change (UNFCCC) has endorsed beams, columns, and the material as a green building material. The panel cavity can be mostly or completely loaded up with fortified cement to give extra quality.
- 6) Usama Hamed Issa et al. [2013] shows this construction involves numerous risk factors that have numerous

impacts on time objective that will cause time-overrun. This study suggests and applies a replacement technique for minimizing risk factors result on time mistreatment lean construction principles.

- 7) Gaurav Saini, Kshitij Pant, Deepanshu Soni, Dipesh Jangid, Jitendra B. Jangid et al. [2019] research has found that gypsum is a durable material. Experts predict that a building made of GFRG panels is expected to have a life span of 60 years. That's why GFRG panels are heavily in use as partition walls. A GFRG building does not require beams and columns. Also United Nations Framework Convention on Climate Change (UNFCCC) has also approved the material as a green building material.
- 8) A. Chandrasekar, M. Logesh Kumar et al. [2014] shows his paper mostly centers on distinguishing the potential outcomes of execution of lean administration in the development industry. Setting up the survey and furthermore directing the meeting with the venture personals like best administration, designers and site administrators and so forth will accomplish it.

III. APPLICATION

GFRG wall panels can be used in construction with following applications:

- 1) As load bearing walls in buildings, to resist gravity load.
- 2) As partition or infill walls in multi-storeyed framed RC structures.
- 3) As compound walls in combination with minimum quantity of concrete.
- 4) As shear walls, to resist both gravity load and lateral load from earthquakes and wind also as walls of lift wells and parapet walls.
- 5) As an intermediate floor or slab in combination with reinforced concrete structures, pitched roof slabs and also as staircase waist slabs and mid-landing slabs.

IV. ADVANTAGES

- 1) High speed of construction.
- 2) More carpet area for the same built-up area: thickness of wall panels is only 124 mm.
- 3) Less embodied energy and carbon footprint significant reduction in use of steel, cement, sand and water, recycling of industrial waste gypsum.
- 4) Less cost of construction: savings in materials; no cement plastering.
- 5) Less building weight (panels weigh only 44 kg/m²), thereby reduction in design for seismic forces and savings in foundation, especially in multi-storey buildings.
- 6) 8 to 10 storey buildings can be designed using GFRG panels, without the need of conventional RC beams and columns.
- 7) Very good finishes of GFRG buildings: use of factory made panels for all the walls, floors and staircases.
- 8) Less CO₂ emission compared to other conventional building materials.
- 9) Better thermal comfort inside GFRG building compared to conventional buildings.

- 10) Since gypsum is a hard material there is no creep in the GFRG panel so it is major asset of this type of construction.
- 11) In this Rapid wall system, there is no volume change even at high temperature.
- 12) The movement of moisture through concrete structures is dampness. There is no dampness problem in GFRG panel wall system.
- 13) The durability of this rapid wall system is same as the RCC construction.

V. DISADVANTAGES

Although theoretically there are no drawbacks of using this technology, a few practical issues do arise

- 1) You do need some expertise in order make a house using this technology. The handling, fixing and equipment requirement for these panels is fairly different from conventional style. Although it is not very difficult to learn the right techniques, it will eventually take time for becoming and industry trend
- 2) The Panels are customized according the design and drawings of your house when manufactured. Unfortunately, you cannot make a lot of changes during fixing stage. Hence planning is important. Also the doors, windows and other openings are made by cutting through the panels, hence the planning for placing doors and windows also needs to be extensive.
- 3) In India, if you looking to do a construction in a normal populated area, it is very likely that your plot is already surrounded by built house. The GFRG technique needs empty space around the plot so that cranes can be placed while fixing panels. Also the panels need special care while storing them and need more space as compared to cement/blocks. These 2 factors make it difficult for a full scale implementation in India Empty space to store and move Panels is needed.
- 4) The fact that panels are specifically made for a design and transported from factory, the price of each type of panel goes done significantly only when used on a large scale. Comparatively you can save 25–30% compared to that of conventional.

VI. CONCLUSION

- 1) Rapid wall Panel provides a new method of building construction in fast track, fully utilizing the benefits of prefabricated, light weight large panels with modular cavities
- 2) By this process, man power, cost and time of construction is reduced. The use of scarce natural resources like river sand, water and agricultural land is significantly reduced.
- 3) Rapid wall buildings thereby reduce burden on the environment and help to reduce global warming. Rapid wall use also protect the lives and properties of people as these buildings will be resistant to natural disasters like earthquakes, cyclone, fire etc.

REFERENCES

- [1] Devdas Menon (2014) "Rapid Affordable Mass Housing using Glass Fibre Reinforced Gypsum (GFRG) Panels" *International Journal of Scientific & Engineering Research*. Volume 5, Issue 7, July-2014 ISSN 2229-5518
- [2] Eldhose M Manjummekudiyil, Basil P Alias, Biji K Eldhose, Sarath Rajan, Thasneem Hussain (2014) "Study of GFRG panel and its Strengthening" *International Journal of Civil and Structural Engineering Research*. ISSN 2348-7607. Vol. 2, Issue 2, Month: October 2014 - March 2015
- [3] Mohamed Said Meselhy Elsaed (2016) "Cost Model for using Glass Fibre Reinforced Gypsum System (GFRG)" *International Journal of Development and Economic Sustainability*. Vol.4, No.3, pp.33-47, June 2016
- [4] Aishwary Shukla, Mohd. Afaque Khan, Abhishek Kumar (2016) "A Review of Research on Building System Using Glass Fiber Reinforced Gypsum Wall Panels" *International Research Journal of Engineering and Technology (IRJET)*. ISSN: 2395 -0056. Volume: 03 Issue: 02 Feb-2016
- [5] Sk. Subhan Alisha, Sajja. Neeraja, S K. Akber, G. Sai Manoj (2016) "Low Cost Housing by Using GFRG Panels" *International Journal of Scientific Research in Science, Engineering and Technology*. Volume 2 Issue 3, ISSN: 2394-4099
- [6] Usama Hamed Issa (2013), "Implementation of Lean Construction Techniques for Minimizing the Risks Effect on Project Construction Time" *Alexandria Engineering Journal* 52(4):697-704
- [7] Gaurav Saini, Kshitij Pant, Deepanshu Soni, Dipesh Jangid, Jitendra B. Jangid "Low Cost Housing by using Glass Fibre Reinforced Gypsum Panels" *International Journal for Research in Applied Science & Engineering Technology* ISSN: 2321-9653; Volume 7 Issue III, Mar 2019.
- [8] A. Chandrasekar, M. Logesh Kumar, "Effective Utilization of Lean Management in Construction Industry", *International Journal of Engineering and Innovative Technology (IJEIT)*, Volume 3, Issue 12, June 2014