

# Comparing Rapid Wall Panel Construction over Conventional Construction with Respect to Cost and Time of Construction

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**Abstract**—Developing countries like India, the construction industries in these countries face challenges regarding raw materials needed for construction of building and to prepare various materials to be used in construction. Currently due to shortage of houses for low income groups in India, there is need for a new well developed and economical method of construction. So new technique rapid wall panel construction is developed. It is basically a wall panel developed from phosphogypsum which is available as a waste product from various chemical, fertilizers plants in huge quantity. It is set towards sustainable development. In this paper we have compared the economy between conventional method and rapid wall method of construction based on cost and time.

**Keywords**—challenge; develop; phosphogypsum; rapidwall; sustainable

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## I. INTRODUCTION

The construction industry everywhere faces problems and challenges. However, in developing countries like India, these difficulties and challenges are present alongside a general situation of socio-economic stress, chronic resource shortages, institutional weaknesses and a general inability to deal with the key issues. There is also evidence that the problems have become greater in extent and severity in recent years. [2]

Traditionally materials like clay, sand, stone, gravels, cement, brick, block, tiles, distemper, paint, timber and steel are being used as major building components in construction sector. All these materials have been produced from the existing natural resources and will have intrinsic distinctiveness for damaging the environment due to their continuous exploitation. The cost of construction materials is increasing incrementally. In India the cost of cement during 1995 was Rs. 1.25/kg and in 2015 the price increased five times. In case of bricks the price was Rs. 0.66 per brick in 1995 and the present rate is Rs. 7 per brick. Similarly, over a period of 20 years from the year 1995 the price of sand has increased five times.[9]

Also due to high transportation costs of these raw materials, demand, environmental restrictions, it is essential to find functional substitutes for conventional building materials in the construction industry.[6]

The threat of climate change caused by the increasing concentration of greenhouse gases in the atmosphere is pushing the whole world into a catastrophic crisis situation with universal concern. The need of the 21st century is for energy efficient and eco-friendly products. The building industry accounts for 40% of CO<sub>2</sub> emissions.[6]

Rapid wall, also called gypcrete panel is an energy efficient green building material with huge potential. It is used as load bearing and non load bearing wall panels. Rapid wall is a large load bearing panel which have modular cavities suitable for both external and internal walls. It can also be used as intermediary floor slab/roof slab in combination with RCC as a composite material. Since the advent of innovative Rapid wall panel in 1990 in Australia, it has been used for buildings

ranging from single storey to medium -high rise buildings. Light weighted Rapid wall has high compressive strength, shearing strength, flexural strength and ductility. It has very high level of resistance to fire, heat, water, termites, rot and corrosion. Concrete infill with vertical reinforcement rods enhances its vertical and lateral load capabilities. Rapid wall buildings are resistant to earthquakes , cyclones and fire. [6].

## II. METHODOLOGY

The methodology will be adopted such as collecting the data from literature reviews, case studies, questionnaires, interviews and site visits. The methodology also includes following point.

- By using the internet net, books and interaction with respective builders/developers.

By understanding the technique of construction of building using rapid wall of specific plinth area by visiting completed or ongoing site and comparing it with conventional building.

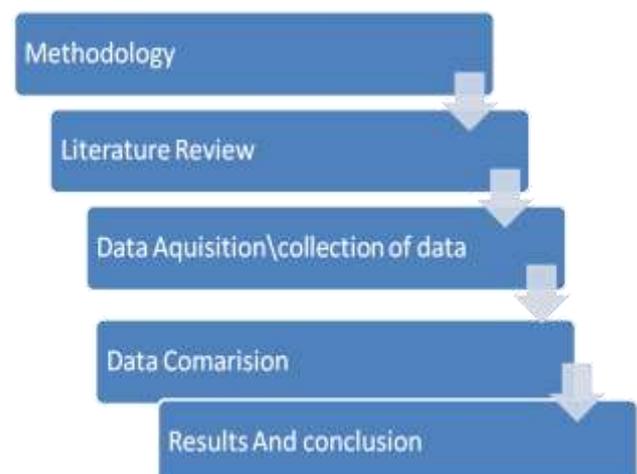


Fig1 .Flow Chart of Methodology

### III. RAPIDWALL PANELS

The rapid wall panels building products have been used in Australian building industry for a decade where it is called Rapid wall. Rapid wall panels are used instead of bricks. Rapid wall panels have undergone testing by Indian authorities and are presently exported to India to satisfy the need for a cost-effective, easy to construct and environment-friendly solution to their housing crisis. Rapid wall panels being low cost building materials, and easy to install, fit exactly the current void or demand for houses in India. Apart from being low cost and easy to install, rapid wall panels are also environment friendly, requires less number of labors (a very important factor in any construction project), versatile use, light weight, easy handling, water resistant and fire proof.[2][6]

Rapid wall panels are Australian developed and manufactured walling product used in building industry to provide habitable enclosures for residential, commercial and industrial buildings. The 120 millimeter thick, lightweight, hollow-core panels are machine-made using formulated gypsum-plaster (Gypcrete) reinforced with chopped glass-fiber. A typical cross-section of the panel is shown in Figure[6]

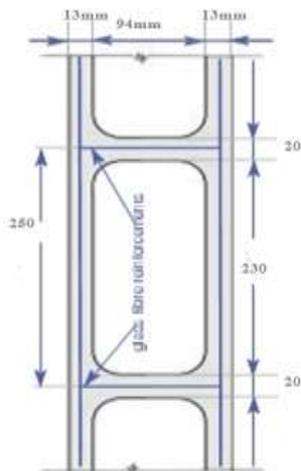


Fig2. Cross-section of rapid wall panel

### IV. OBJECTIVES

- To make the economical comparison between construction of building using rapid wall panel and conventional method.
- Time analysis and effect on total construction duration.
- To understand the technology of Rapid Wall construction thoroughly.

### V. PHYSICAL AND MATERIAL PROPERTIES

Rapid wall panel is world's largest load bearing lightweight panels. The panels are manufactured with size 12 m length, 3m height and 124 mm thickness. Each panel has 48 modular cavities of 230 mm x 94 mm x 3m dimension. The weight of one panel is 1440 kg or 40 kg/sqm. The density is 1.14g/cm<sup>3</sup>, being only 10-12% of the weight of comparable concrete /brick masonry. The physical and material properties of panels are as follows [6]

Table1. Physical Properties of Rapid wall

Material/items	Rapid wall Building
Weight- light weight	40 kg/sqm
Axial load capacity	16 tons/m
Compressive strength	73.2 kg/cm <sup>2</sup>
Unit Shear strength	50.90 kN/m
Flexural strength	21.25 kg/cm <sup>2</sup>
Tensile Strength	35 kN/m
Ductility	4
Fire resistance 4 hr rating withstood	700-1000 °C
Thermal Resistance	0.36 kw
Elastic Modulus	3000-6000Mpa
Sound transmission	40
Water absorption	< 5 %

### VI. MANUFACTURING PROCESS

Phosphogypsum is a byproduct of phosphoric acid plant is calcined in calciner at 140-1500 °C at the rate of 15MT/hr. This calcined plaster product is stored in silo of having capacity 250MT. With the help of screw conveyors this plaster is transferred to batch hopper and through Entoleter in Rapid wall panel manufacturing area. This area consists of casting tables having dimensions of 3m x 12m One crab having mixer and glass roving delivery system is for delivering slurry and glass roving. The chemically added water is used to form Gypsum slurry. One layer of slurry is laid on the table by the crab followed by a layer of glass roving. This glass roving is embedded in to the slurry with the help of layer of glass roving. This glass roving is embedded in to the slurry with the help of glass roving this layer is pushed inside the ribs with the help of temping bar. Finally a layer of glass roving is laid for the top face of the wall panel.[4]

The casted panel is lifted to ACROBA frame and shifted to dryer for drying. The wall panel is dried at a temperature of 275° c for 60 minutes. After drying, the wall panel is either shifted to storage area or on the cutting table. The wall panel is cut as per dimensions supplied by the client and the cut pieces are transferred to still ages which are specially made for transporting wall panel.[4]

The waste liquid effluent generated during manufacturing process can be recycled back in the system for manufacturing of new wall panels, also the solid waste which is generated during manufacturing process is recycled to the calciner after crushing and separating plaster and glass roving in recycle plant.[3][4]

### VII. RESULT AND DISCUSSION

The calculation mentioned in the table is for 4 storied building which consist of 14 flats. The total area of project is 482 meter square.

I have studied the scope of project. After that I have decided to do comparative study between rapidwall construction and conventional building. After that I have studied technology and details of rapid wall panel. In this, all the analytical part part of various components is done in the project and it is compare with conventional building. The actual comparison is done between rapid wall panel and conventional building with respect to the cost and time.

Table2. Comparison between Rapid Wall Construction and Conventional Building

Sr No.	Materials/ items	Rapidwall Building	Conventional building	Saving in %
1	Bricks	0	965327	-
2	GFRG Panel	2044	0	-
3	Water	160000 ltr	666000 ltr	75.98
4	Construction Time	66 days	200 days	67
5	Construction Cost	32.73 lakh	44.80 lakh	26.94
6	Accuracy	MORE	LESS	-
7	Transportation	MORE	LESS	-

### VIII. CONCLUSION

Rapidwall construction is a new approach to construction. It is better in all aspects related to conventional method of construction. This method of construction takes a giant leap towards sustainable living creating a positive effect on environment. It is more affordable housing to low income groups.

Use of rapid wall protects the lives of people as these buildings will be resistant to natural disasters like earthquakes, cyclone, fire etc.

After detailed study and analyze of building it is observe that rapidwall construction saves 67% in construction time and 27% in construction cost compare with conventional building.

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### REFERENCES

- [1] Publication "SHELTER" volume14 no.1 April 2013
- [2] Adelaida Cristina Hontus "Comparative study on choice of building materials for constructing a house." Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 14, PRINT ISSN 2284-7995, E-ISSN 2285-39. Issue 4,( 2014)
- [3] Building Materials in India: 50 Years, BMTPC, 1998 First edition.
- [4] <http://www.rapidwall.com>
- [5] Ignacio Zabalza Bribian, Antonio Valero Capilla, Alfonso Aranda Uson "Life Cycle Assessment of building material: comparative study of energy and environmental impact and evaluation of eco-efficiency improvement potential." Building and Environment 46, 1133-1140:(2011)
- [6] Glass fibre reinforced gypsum load bearing (gfrg) Panels for affordable housing in fast track & Environmental protection
- [7] Nurhayat Degirmenci "The using of waste phosphogypsum and natural gypsum in adobe stabilization" Construction and Building Materials 22, 1220-1224:(2008)
- [8] Rapid Wall sales brochure.
- [9] Y.-F. Wu, "The structural behavior and design methodology for a new building system consisting of glass fiber reinforced gypsum panels" Construction and Building Materials, Volume 23, Issue 8, Pages 2905-2913, August 2009.
- [10] Abdulmohsen Al-Hammad and MohammadA.Hassanian,VALUE ENGINEERING IN THE ASSESSMENT OF EXTERIOR BUILDING WALL SYSTEMS,Journal of Architectural Engineering ,September 1996,pages 115-119
- [11] Wu YF. A 2002 report into the physical testing and the development of design guidelines for the structural application of Rapidwall in building construction. Adelaide (Australia): Dare Sutton Clarke Engineers; 2002.
- [12] Wu YF, Dare MP. Axial and shear behavior of glass fiber reinforced gypsum wall panels: tests. J Compos Constr ASCE 2004;8(6):569-78.
- [13] Wu YF. The effect of longitudinal reinforcement on the cyclicshear behavior of glass fiber reinforced gypsum wall panels: tests. Eng Struct 2004
- [14] Stan Daniel, 2004, Building and Environment, Matrix Rom Publishing House, Bucharest
- [15] Suman, R., Ghibu, M., N. Gheorghiu, Oană, C., Oțel, A., 1988, Modern technologies in construction, Technical Publishing House, Bucharest
- [16] Șerban Liliana, 1998, , Building Materials, Matrix Rom Publishing House, Bucharest
- [17] Guidelines on Sustainable Human Settlements Planning and Management, Economic Commission for Europe, United Nation, New York and Geneva, 1996
- [18] Design specifications for construction vol I, II, III (collectively STAS)
- [19] Standards, regulatory and other requirements in force
- [20] Janardhana M, Prasad AM, Menon D. Studies on the behavior of glass fiber reinforced gypsum wall panels. In: Proceedings of the 8th US national conference on earthquake engineering, San Francisco, California, USA; 18-22 April 2006. Paper no. 1326.
- [21] Janardhana M, Prasad AM, Menon D. Behavior of glass fiber reinforced gypsum wall panel under cyclic lateral loading. In: Proceedings of the fourth international structural engineering and construction conference (ISEC-4), Melbourne, Australia; 26-28 September 2007. p. 707-11