

## **Infill Wall System, an Alternative to Conventional bricks**

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**ABSTRACT:** *With the boom in construction industry the requirement of building materials have increased. As burnt brick are the most popular building material for construction of wall in India. However the conventional brick making is recognized as a resource intensive, energy inefficient & highly polluting industry by the Central Pollution Control Board (CPCB). As the conventional methods are having disadvantages so, there is need for finding a suitable alternative for the conventional brick wall so as to minimize the environmental issues related and also to reduce time and manpower required in the conventional process which is the need of the construction industry. In case of the multistoried building wall construction is one of the major item which is required for the partition work and to create various internal units. Use of the conventional bricks consume a lot of time and manpower from its layout to finishing work, so there is need to find an alternative to the conventional brick walls and moreover lot of dead weight is imposed on the structure due conventional method, so use of light weight material is needed so as to reduce the dead load on the structure. Materials with less cross sectional area had to be used to increase the overall carpet area. So, modern methods has to used which will reduce the time, manpower and material required such as sand and cement which will be more advantageous in case of mass housing, commercial and multistoried building as the saving in time and manpower will ultimately lead to reduce the cost of the project, efforts has to be made result in overall saving in time, manpower steel requirement which can help to achieve economy*

**Keywords:** *CLWC, Drywall, Gypsum based wall panels, Infill wall.*

### **1. INTRODUCTION**

As the Indian population continues to grow the requirement for food , power and housing is increasing., [1] as the majority of power generated to fulfill our demand is from thermal power plant where coal is used as fuel which results in the generation of flyash leading to environmental and disposal issue. It is mainly disposed by landfill method , but this by product of thermal power plant which was considered as polluting industrial waste has proven suitable for variety of application, one of the innovative and commonly use is in the manufacturing or green building material known as cellular light weight concrete/foam concrete which are proving as an substitute to conventional bricks and many more advantages discussed later. Now a days [2] Green building index which is considered as the tool for evaluating the siting, design and performance of buildings and infrastructure based on worldwide acceptable criteria invented after Kyoto protocol, according to which light weight concrete helps in reducing the energy consumption and green house gas emission as that of traditional material such as conventional bricks etc. Gypsum is a by product of fertilizer manufacturing as the demand of food is increasing the generation of gypsum as a by product is also increasing

With the boom in construction industry the requirement of building materials have increased. As burnt brick are the most popular building material for construction of wall in India. However the conventional brick making is recognized as a resource intensive, energy inefficient & highly polluting industry by the Central Pollution Control Board. The environmental problem due to the brick industry have increased as it requires raw materials like soil, water, coal, biomass and labour. This results in irreversible environmental damages in terms of depletion of top layer agricultural soil & valuable national resource as coal, water etc. With unabated increase in the price of coal & higher costs of transportation, the brick industry is not left with much choice but to opt for poor grade coal. The poor quality of coal (low calorific value) increases the consumption rate & causes high level of air pollution, the emission of suspended particulate matter & considerable amount of green house gas.

Disadvantage of using Bricks like, its manufacturing create pollution, non uniformity in size & shape, non standardization in properties, wastage during shifting, speed of work cannot be increased as it takes long time to complete the work with the conventional process it creates a dirty site because of wet construction system and materials are also heavy and inconvenient to transport. In addition, skillful craftsmen are required. Many defects often occurs like cracking or rough and uneven surfaces because bricklaying and cement rendering are not standardized. Due to this more consumption in cement and sand for the plastering work furthermore, it is difficult to control the loss of materials during construction which emphasizes on speed, safety and beauty as the key priority.

## **2. PRESENTLY USED MATERIALS FOR WALL CONSTRUCTION**

Conventional bricks & concrete block

Burnt clay bricks of 4" and 6" are used for construction of 9 inch, 6 inch and 4 inch thick wall.

Process is conventional and no scope to reduce the time required for completing the work.

Bricks are not standardized.

Uneven in shape. Variation in properties.

Manufacturing creates pollution.

Wastage of natural resources such as agricultural fertile soil and coal are consumed.

Energy inefficient and lot of wastage due to over burning in manufacturing process.

Construction by brick creates dirty and wet site.

Wastage during shifting and transportation.

## **3. NEW MATERIALS AND METHOD IN DEVELOPING COUNTRIES**

Light weight Gypsum partitions, fiber board paneling walls are used.

Light weight cellular materials and foam concrete are used.

Materials with less cross sectional area are used.

Directly casting of wall with the help of special formwork.

### **3.1 Drywall Technology**

[4]Over 80 per cent of all interior construction in the developed countries across all applications is with drywalls. A growing trend in India's healthcare industry is seeing a transformation with the adoption of drywall technology to build hospitals like The Asian Heart Institute - Mumbai, Seven Hills - Mumbai, Wockhardt - Mumbai & Kolkata, Beams Hospital - Hyderabad & Bangalore, Medicity-Gurgaon, to name a few. Gypsum products have been used over centuries in the construction space and are the material of choice because of gypsum's unique properties. Gypsum is used as plasterboard to create false ceilings and high performance drywalls and partitions. Plasterboard is one of the earliest and most versatile prefabricated construction materials that continue to outstrip construction growth in most countries.

Gypsum plasterboard/ dry wall [3][5] systems are very fast to erect and provide huge labour saving and flexibility in construction. Globally, gypsum drywall systems are used as a replacement of brick and mortar construction. In the developed world, the building solutions are fairly advanced from a performance point of view as the construction practices have evolved over a period of time. In India the construction practices are evolving and hence the use of advanced building systems focused on performances like fire, acoustics etc. is not very wide spread as yet. Most of the well-renowned hospital chains are built with stringent fire safety requirements of at least 1-2 hours for all internal walls and acoustic insulation requirements of 50+ dB to ensure acoustic comfort for their patients thus making traditional construction materials obsolete. These requirements are met by gypsum plasterboard based drywall solutions which have the following benefits:

[6][7]Light weight systems – 8 to 10 times lighter than conventional systems like Brick / Block work.

Faster construction – Five to eight times faster.

Superior acoustics performance in terms of insulation with insulation rating upto 74 dB.

Tested and certified systems to give between 1/2 – 4 hour fire rating.

Smooth finish, aesthetically beautiful crack free surfaces.

Flexibility in terms of modifications and refurbishment at some point in time.

Green and recyclable product.

All these benefits packaged in one system are a rare combination and they give architects the flexibility in designing spaces of the future. Over 80 per cent of all interior construction in the developed countries across all applications is with drywalls.

### **3.2 Advantages of Gypsum-based Drywall Construction Materials**

Conventional Internal Wall Systems in use currently

Brick & Masonry

- In this type of construction quality of brick and sand varies as components sourced from various vendors may not be up to the desired standards, which greatly affects the performance of the system in terms of acoustics and fire.

- There is a huge cost involved for the transportation of large volumes of brick, sand, cement etc.
- There is also the possibility of messy work in progress and waste being accumulated at the site of construction.
- Brick and masonry wall systems are more prone to shrinkage cracks.
- Brick and masonry construction is also time consuming as it's a wet construction process and involves curing at various stages.

### 3.2.2 Advantages of Drywall Construction

1. [3][5] In drywall construction, the construction time is five to eight times faster and is non-messy: Gypsum is used as Plasterboard to create false ceilings and high performance drywalls and partitions. Gypsum plasterboard systems are light-weight and therefore can provide huge structural savings if incorporated at the design stage of the project as using these systems reduces the dead-load onto the structure by a huge margin. These systems are very fast to erect and provide huge labour saving and flexibility in construction. Globally reinforced gypsum wall panels are used as a replacement of wood, brick/masonry construction, and for screeds to be used on floors.

2. Drywalls offer excellent performances in terms of fire protection and thermal insulation: Gypsum based products and systems provide excellent passive fire protection solutions ranging from 1/2 hour to four hours taking care of all three elements of fire protection - stability, integrity and insulation requirements of the system in equal measure. Gypsum contains approximately 21 per cent of crystalline water and about 79 per cent Calcium Sulphate which is inert below a temperature of 120° C. The bound crystalline water in gypsum plays a significant role in excellent fire resistance properties which makes gypsum a material of limited combustibility as first the crystalline water gets evaporated from the gypsum core in case of a fire.

3. Drywalls offer excellent performance in terms of sound insulation: Given the fact that conventional walls (wooden, brick, block or concrete) offer poor sound insulation it is important to look at alternative light-weight construction forms like drywalls to achieve high levels of sound insulation. While designing spaces, it is important to understand the acoustic requirements in terms of sound absorption and insulation and other sound

levels in order to create the perfect acoustic comfort. The correct room design and the right building material go hand in hand in delivering the perfect room acoustics. Studies have shown that acoustically designed spaces can facilitate a disturbance free environment in hospitals thus ensuring faster patient recovery.

4. Drywalls are lighter – 8 to 10 times lighter than masonry systems: The key requirements for building tall buildings or huge structures will be to incorporate materials that are light-weight which can reduce the dead-load on the structure, faster to construct, eco-friendly, have a long life, have more stringent fire safety requirements, and provide better acoustic comfort thus making traditional construction materials obsolete. These requirements are met by gypsum plasterboard based Drywall Solutions.

5. Drywalls are energy efficient and eco friendly in nature: The thermal insulation provided by Drywalls is 5 times better compared to brick or block wall owing to low Thermal Conductivity. This low thermal conductivity and high Thermal Resistance results in bringing down the electrical consumption of a building as it reduces the load on the Air-Conditioning units. Drywalls are made of Gypsum which can be sourced from natural reserves and is found abundantly in various parts of the world. Also, another variant is Phosphogypsum which is generated as a by-product of the phosphoric acid based fertiliser industry. Furthermore Gypsum is a 100% recyclable material.

6. Drywalls are aesthetically more appealing, they offer flexibility in creating and dividing spaces and also allow to experiment with shapes and sizes: Drywalls (as the name implies) is a dry construction technique to build walls which are lighter and faster to construct. A drywall consists of a Gypsteel ultra steel framework (studs, floor and ceiling channels) fixed to Gyproc gypsum plasterboards on both the face sides. The same is then finished using a Gyproc jointing compound and Gyproc paper tapes for a monolithic finish. Between the metal stud partitions is an air gap which can be filled with glass wool insulation to get higher fire and acoustic performance ratings.

The European and other western countries have adapted the Gypsum advantage for their interior solutions, India is yet to catch up. Over the next few years, through a combination of efforts made by the gypsum producers, adoption of modern construction techniques by builders and greater demands by end clients for high performing environmentally friendly buildings this category is set for a significant growth.

### 3.2.2 Gypsum-based wall panels set to replace brick wall

[5] To cater to the building construction industry, FACT-RCF Building Products Ltd (FRBL) is a joint venture undertaking of the Fertilisers and Chemicals Travancore Limited, Udyogammndal, Kerala and Rashtriya Chemicals and Fertilisers, Mumbai both are public sector undertakings manufacturing chemical fertilizers. Gypsum is a by product of fertilizer manufacturing, gypsum-based wall panels technology is developed in the market these load bearing gypsum panels replace brick walls. Building construction using these panels reduces construction time substantially, besides saving in labour cost, steel and water consumption, he added. FACT has a stock of about 60 lakh tones of gypsum. FRBL wall panels manufactured from this gypsum is a new concept in modular prefabricated housing solution. These panels are available in 12 x 3 metre size with 124 mm thickness, which can be cut into size as per the requirements of the customers. Besides, these panels are lightweight and construction using this conforms to the green building concept with saving in energy.

### 3.2.3 Cellular Lightweight Concrete (Foam Concrete) Block Equipments

What is foam concrete and how it is made?

[2][7] Foam Concrete is also Known as Cellular light weight concrete, 'CLC', Foamed cement, Light Weight Concrete across the world with its greater advantages from 5 years. The basic foam concrete is made from mixing aqueous foam which is produced from generators into Slurry of Cement, fly ash or sand, water and other additives in a precise mixing in foam concrete mixer for accurate mixing without disturbing its original chemical and physical properties. The Final mixture Results many small air cells uniformly distributed throughout the concrete which will creates cellular structural material densities ranging from 300kgs/m<sup>3</sup> to 1800kgs/m<sup>3</sup> with compressive strengths between 5kgs/cm<sup>2</sup> to 200kgs/cm<sup>2</sup>. The Precise Controls of the volume of air cells in foam concrete will results controlled densities and strength's of foam Concrete. The final mixture is either pumped or transfers manually for casting of blocks, panels, precast items, prefabricated houses, void fillings, roof insulations, floor Screeds and many other applications without any vibration or Compaction. Foam Concrete manufacturing consumes higher amounts of fly ash (which is waste material from thermal power stations) hence it is consider as green building material. At present foam concrete is using in construction for many applications throughout the world from last four to five decades.

#### 3.2.3.1 Advantages

Light in weight, High thermal insulation, High fire protection, High sound insulation, Lower water absorption, Eco friendly.

#### 3.2.3.2 Applications

Blocks, Panels, Ceiling panels, Pre-cast exterior walls, Void filling, Roof insulation, Thermal insulations, Sound insulation, floors, Cast insitu applications, Tank infill, Road construction, Subway infill, Tunnel infill, Mine infill, Floors, Low cost housing.

## 4. CONCLUSION

If we compare the modern methods and conventional method of wall construction there is lot of scope and advantages of modern material and method in the construction of infill wall, than that of conventional material and method, as they not only green building material but they can also lead to lot saving in time and cost if it incorporated in the design part of the project.

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