

A Review on Dry Wall Construction Technique in Reference of Sustainable Development

Mr. Dhiren K. Paghdar*,

**Student of final year M.E (Construction management), S.N.P.I.T. & R.C, Umrakh Bardoli, Gujarat, India.*

Dr. Neeraj D. Sharma **

***Head & Associate professor, Civil Engineering Department, S.N.P.I.T. & R.C, Umrakh, Bardoli, Gujarat, India.*

Mr. Hiren A.Rathod***

****Assistant professor, Civil Engineering Department, S.N.P.I.T. & R.C, Umrakh, Bardoli, Gujarat, India.*

Abstract

Drywall (also known as Plasterboard, Wallboard, Gypsum board, Or Gyprock) is a panel made of gypsum plaster pressed between two thick sheets of paper. It is used to make interior walls and ceilings. The new drywall will contain the paraffin capsules for almost half the mix. The new drywall will be filled with tiny beads of paraffin that would absorb heat during the day, and release it at night. It could be the latest thing in green building technology. This type of construction is suitable and can be applied for all commercial and residential projects, such as: Model houses/ apartment, studio apartments, Residential homes, office building, factories, departmental stores, etc. These are light weight systems – 8 to 10 times lighter than conventional systems like Brick / Block work, comparatively much faster construction, almost – five to eight times faster along with smooth finish, aesthetically beautiful crack free surfaces. Besides the newly mined material, up to 20% of the gypsum used to manufacture drywall can be recycled from waste generated at the manufacturing plant or at construction sites. The content covered in this paper gives a highlight on the overall system of dry wall and the concept has been diverted in the viewpoint of sustainable development and managerial benefits at construction sites.

Keywords: Gypsum; Drywall construction; conventional masonry; recyclable

1. Introduction

Drywall (also known as Plasterboard, Wallboard, Gypsum board, Or Gyprock) is a panel made of gypsum plaster pressed between two thick sheets of paper. It is used to make interior walls and ceilings. Drywall construction became prevalent as a speedier alternative to traditional lath and plaster.

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 calcium sulphate dehydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), a naturally occurring mineral that is mined from dried ancient sea beds. 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 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.

2. Components of Dry Wall Construction

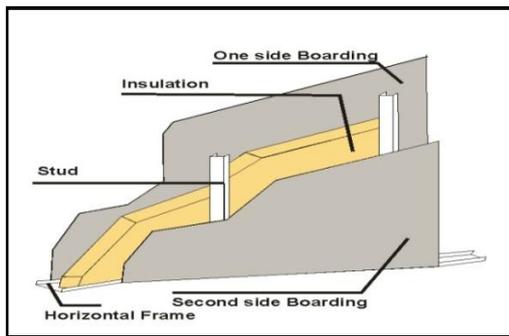


Figure 1: Components of Dry Wall

Source: [https://www.google.co.in/search/component of dry wall](https://www.google.co.in/search/component+of+dry+wall)

2.1 Insulation

There are various types of insulation commonly found in residential and commercial buildings. Insulation is used to make things airtight and save person's money on their energy bill. Walls, ceilings and floors that are well-insulated will keep cold drafts out during the wintertime, holding the heat in and causing lower energy bills. Various insulation materials listed below

- Rock and slag wool batts
- Fiberglass batts
- Polystyrene board
- Cardboard
- Fiberglass rigid panel

2.2 Stud

Studs used to frame around window and door openings are given different names, including

- king stud – stud to left or right of a window or door that is continuous from the bottom plate to the top plate
- trimmer or jack – stud to the left or right of a window or door that runs from the bottom plate to the underside of a lintel or header
- cripple stud - a stud located either above or below a framed opening, that does not run the full height of the wall
- post or column – a doubled or other integral multiple of a group of studs nailed side by side, or (equivalent, a metal sheathed concrete filled column) used in a load bearing wall to transfer the weight of an upper structure to the bearing wall of a foundation, footing, and

ground. Posts in walls are most common near high decorative windows, long spans near a wide window or sliding door, and other locations where architectural beauty conflicts with the need for engineering strength and safety.

2.3 horizontal frames

Drywall framing is a specialized construction technique used to prepare a wall for installing drywall, or gypsum board. Because drywall sheets are manufactured to a universal size, all framing on which these boards, or sheets, will be installed must comply with specific dimensions. Otherwise, drywall sheets will all need to be custom cut to fit wall and ceiling studs, at additional cost in labour and material. To achieve framing at the most reasonable cost of material and labour, use the information below.

2.4 Boarding

Material used for boarding

- Fibre cement board
- Fibre rock
- Gypsum board(Dry Wall)
- Calcium silicate board

Features of Gypsum board (Dry Wall):

Gypsum Board is made up of "Pressing gypsum plaster together very tightly between two very thick sheet of paper/ fiber glass.

Gypsum is a mineral found in sedimentary rock formations in a crystalline form known as calcium sulfate dehydrate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. 100 pounds of gypsum rock contains approx 21 pounds of chemically combined water. it is mined or quarried & transported to the manufacturing facility. The manufacturer receives quarried gypsum & crushes the large pieces before any further processing takes place. Crushed rock is then ground into a fine powder & heated to about 350 degrees F, driving off 3/4 of the chemically combined water in a process called calcining. The calcined gypsum $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ is then used as the base for gypsum plaster, gypsum board & other gypsum products.

- Dry wall is very easy to installation
- It has good Fire Resistance capacity
- The Sound Isolation capacity of Dry wall is up to 75db
- It is a very Versatile material
- It is Economical, thus save cost.

3. Process of Dry Wall Construction

Installing drywall can be easy, but taping the joints between panels requires some practice. Some do-it-yourselfers install the drywall themselves, and then call an experienced drywall tapper to finish the job.

Although it's easy to figure how much drywall to buy (just compute the square footage of the walls and ceiling), it takes some planning to end up with as few joints as possible. The standard-size sheets for walls measure 4×8 feet. They are usually installed with the long side running from floor to ceiling, but if you can eliminate a joint by placing them horizontally, do so. All drywall sheets are 4 feet wide, but many building-material outlets offer 10-foot and even 12-foot lengths. The most popular thicknesses of drywall are 1/2 inch (walls) and 5/8 inch (ceilings), but check your local building code for requirements.



Figure 2: installation procedure of Dry Wall

Source: [https://www.google.co.in/search/system of drywall installed](https://www.google.co.in/search/system%20of%20drywall%20installed)

Step 1: Construct a pair of T-braces from 2 × 4s about an inch longer than the distance from floor to ceiling. Nail 2 × 4s about 3 feet long to one end of each longer 2 × 4 to form the Ts. Alternately, adjustable T-braces can be rented.

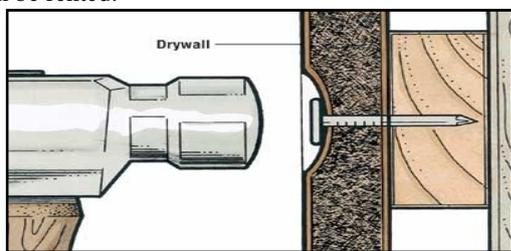


Figure 3: Nail driving

Source: 2006 Publications International, Ltd.

After you drive each nail in, give it an extra blow to dimple the surface without breaking the drywall face paper.

Step 2: Cut drywall panels to size. Use a sharp utility knife along a straightedge to cut drywall. After you make the cut through the face paper, place the board over a length of 2 × 4 laid flat on the floor, or some other type of support, and snap the scored section down. The gypsum core will break along the line you cut. Then turn the panel over, cut the paper on the other side, and smooth the rough edges with very coarse sandpaper on a sanding block.

Step 3: Install drywall panels on the ceiling. If possible, try to span the entire width with a single sheet of wallboard to reduce the number of joints. Position and wedge the T-braces against the drywall sheet to hold it in place until you finish nailing it.

Step 4: Drive nails at 6-inch intervals into all the joists covered by the sheet. Start in the center of the drywall panel and work out. Give each nail an extra hammer blow to dimple the surface slightly without breaking the face paper.

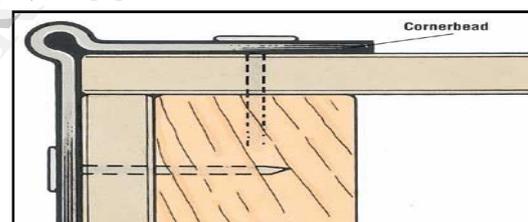


Figure 4: Corner bead for Nail fitting

Source: 2006 Publications International, Ltd.

It is not necessary to dimple the nails of outside corner bead, because the surface will be covered with drywall putty.

Step 5: When the ceiling is finished, cut and install wall panels. Carefully measure for any cut outs in the drywall, including electrical outlets, switches, or light fixtures. To make cut outs, draw a pattern of the cut-out on the wallboard, drill a hole on the pattern line, and then use a keyhole saw to follow the pattern.

Step 6: Space the nails 6 inches apart along studs, but start nailing 4 inches from the ceiling. But the wall panels against the ceiling sheets. Dimple all nails. Nail metal outside corner beads to cover any outside corners.

4. Recyclable Product

Normal drywall is made from gypsum-based plaster. The new drywall will contain the paraffin capsules for almost half the mix. The new drywall will be filled with tiny beads of paraffin that would absorb heat during the day, and release it at night. It could be the latest thing in green building technology. As the building heats up during the day from sunlight, human activity, computers, appliances, etc. the beads of paraffin in the drywall will turn into a liquid state as they absorb the heat inside the building. This helps cool the building. Conversely, at night when the beads start to return to a solid it releases the stored heat, keeping the building warmer. It could very well save a building's energy consumption by 40%.

Plaster made from gypsum has been used as a construction material for thousands of years. In fact, plaster applied at least 4,000 years ago to walls inside the Great Pyramids of Egypt is still in good condition. Today drywall panels are widely utilized in modern construction around the world.

The primary component of drywall is the mineral gypsum. It is a light-density rock found in plentiful deposits worldwide. Each molecule of gypsum (or dehydrated calcium sulphate) is composed of two molecules of water (H₂O) and one of calcium sulphate (CaSO₄). By weight the compound is 21% water, but by volume it is nearly 50% water. Because the water present in gypsum is in crystalline form, the material is dry. Although ice, another form of crystalline water, becomes a liquid at room temperature, the water bound in the gypsum molecules remains solid unless it is heated to 212°F (100°C), at which point it changes to a gaseous state and evaporates.

Millions of tons of gypsum are mined each year in North America, and gypsum board is the principal product in which it is used. Besides the newly mined material, up to 20% of the gypsum used to manufacture drywall can be recycled from waste generated at the manufacturing plant or at construction sites. Gypsum produced as a by-product of the flue-gas desulfurization process at electric power plants provides an economical, environmentally sound raw material for making high-quality gypsum board. Two types of paper are used in the production of most drywall, and both types are made from recycled newspaper.

5. Features of Dry Wall Construction

Dry wall construction is neither of new technology nor recently adopted, but on other hand it is widely adopted worldwide and is in use since long time, because of its mentioned features, even not so explored and adopted in Indian market.

- Dry wall partition systems are suitable for wide range of decorative finish.
- Services and electrical cables can be easily accommodated.
- It provides smooth, seamless and crack free wall surface.
- It can achieve fire resistance from 30 to 240 minutes depending upon the insulation we use.
- It can achieve a sound insulation of 45 to 56 dB .
- The fastest way of refurbish existing walls.
- It easy and quickly installed by nails or screws.

6. Application

Generally this type of construction is preferred as an alternative available for partition walls within a structure because of its several advantages as stated and explained in proceeding sections. Anyways this type of construction is suitable and can be applied for all commercial and residential projects, such as: Model houses/ apartment, studio apartments, Residential homes, office building, factories, departmental stores, hospital and restaurant etc.

7. Advantages

Dry wall construction has the following advantages as compared to conventional wall construction:

- 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 ½ – 4 hour fire ratings.
- Smooth finish, aesthetically beautiful crack free surfaces.
- Flexibility in terms of modifications and refurbishment at some point in time.
- Green and recyclable product.

8. Conclusion

As mentioned earlier dry wall construction is neither of new technology nor recently adopted, but on other hand it is widely adopted worldwide and is in use since long time, because of its mentioned features and advantages over conventional wall construction techniques, but even though not so explored and adopted in Indian market. It has started recently at some places in the country, and is on initial stage as compared to other nations. From the content covered in this article the concept of the dry wall can also draw an attention towards the sustainable approach to the construction. Neither the masonry units are used nor the binding materials e.g. mortar, and hence all the natural resources getting consumed by it are preserved; avoidance of cement is of great importance in achieving sustainable credits; ease in repairs and maintenance and hence saving in repair materials, efforts and cost; saving in efforts, cost and resources for handling of walling unit as compared to conventional walling unit; increase in project value due to reduced construction period with greater finish and ability of ease alterations; greater structural benefits due to vast reduction in dead loads and hence the saving in natural resources, reduction in construction time and cost; great savings in operating the structure in the terms of light and temperature due to better insulations, hence saving in the energy for maintaining the light and temperature; an eco-friendly construction material due ability of recycling and reusing. Hence, this technique can be viewed as a revolutionizing the Indian construction industry because of its great benefits which helps the faster and quality development with lower costs and sustainable benefits.

Acknowledgements

The authors are thankfully acknowledge to Mr. J. N. Patel, Chairman Vidyabharti Trust, Mr. K. N. Patel, Hon. Secretary, Vidyabharti Trust, Dr. H. R. Patel, Director, Dr. J. A. Shah, Principal, S.N.P.I.T. & R.C., Umrakh, Bardoli, Gujarat, India for their motivational & infrastructural supports to carry out this research.

References

- [1] HemantKhurana, "Advantages Of Drywall Technology", Healthcare Financial express, 2010.
- [2] Donald B Munro, "Drywall Recycling Through Agricultural Applications", Construction Resource Initiatives Council- Conseil D'Initiatives Des Ressources De Construction. May 29, 2013.
- [3] Erich Seber, CPE, "How To: Estimate The Cost Of: Installing & Finishing Drywall With Special Consideration Above 10' In Height" Estimating Today, July 2011.
- [4] "Design And Construction Guidelines And Standards: Gypsum Drywall" Dhcd Massachusetts August 2011.
- [5] Fred Fischer Marketing Director, "Solid Dry Wall Construction With Gypsum Blocks", www.multigips.com, February 2008.
- [6] United States Gypsum Company "Product And Systems Technology: Comparing Regular Plaster, Veneer Plaster, And Drywall Systems" 800 USG.4YOU (874-4968) usg.com, U.S.A., October 2010.
- [7] South African Building Interior Systems Association, "General Specification for Drywall Partitions And Lightweight Internal Walls" AAAMSA 2004.
- [8] <http://home.howstuffworks.com/how-to-install-drywall.htm>
- [9] healthcare.financialexpress.com/201010/strategy03.shtml
- [10] en.wikipedia.org/wiki/Drywall
- [11] www.dryco.ca/sound-proofing/quietsolution.htm
- [12] home.howstuffworks.com/drywall1.htm
- [13] ljfletcherbuilders.co.uk/an-introduction-to-dry-wall/
- [14] http://www.youtube.com/watch?feature=player_detailpage&v=ED7rNvxWrkk

IJERT