

NEW GREEN BUILDING MATERIALS & THEIR BENEFITS

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ABSTRACT

A green building, which is also known as a sustainable building is designed to meet some objectives such as occupant health using energy, water and other resources more efficiently and reducing the overall impact to the environment. It is an opportunity to use the resources efficiently while creating healthier buildings that improve human health, build a better environment and provide cost savings. All the development projects lead to over consumption of natural resources. This leads to serious environment problems. Green building concept deals with the optimum use of natural resources for development of infrastructure. The low cost eco-friendly construction with use of recycled plastic, recycled aggregates and municipal wastes for the construction of pavement has considerable effect on the environment of the earth. Another advanced method of construction of low carbon building which uses sustainable materials like blended cement, compacted fly ash blocks, rammed earth walls, low energy intensity floor and roofing system, stabilized mud blocks etc. ultimately results in reduction of greenhouse gases which will help in greenhouse effect. Further development of new materials and methods helps in reducing depletion of resources and reduction in adverse impacts of climate change.

Keywords – Fly ash bricks, energy bricks, Green leaf brick, Thermo brick, strategy.

I. INTRODUCTION

The green building concept mainly focuses on efficiency in use of land, water, material, energy and other areas. The main principle of material efficiency involves minimizing the use of non-renewable construction materials and maximizes the use of re-usable, renewable, sustainably managed, bio-based materials. With the efficiency measures one can achieve efficient engineering, design, planning, construction and effective recycling of construction debris.

II. STRATEGIES INVOLVED

- Optimize the use of engineered materials which provide high strength and durability with least amount of material.
- Identify ways to reduce the amount of material used and reduce the amount of waste generated

through implementation of construction waste reduction plan.

- Identify ways to use high-recycled content materials in the building structure and finishes.
- Explore the use of bio-based materials and finishes such as various types of agriboard.
- Evaluate all products and systems used for their ability to be recycled when they reach the end of their useful life.
- Recognize that transportation becomes part of product or building materials embodied energy.

III. MATERIALS USED IN GREEN BUILDING

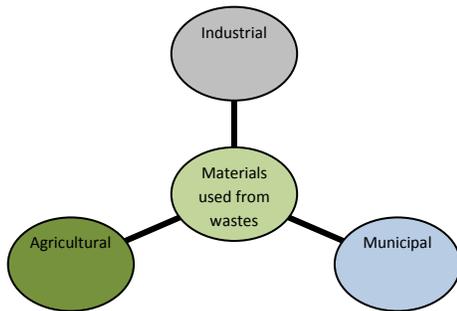
The materials can be obtained from many ways like agricultural wastes, timber, industrial etc. Nonhazardous industrial materials, such as coal ash, foundry sand, construction and demolition materials, slags and gypsum, are valuable by-products of industrial processes. The materials have many of the same chemical and physical properties as the virgin materials they materials- they can even improve the quality of a product. Applications like sheathing and insulation board made from agricultural waste and by products, including straw, wheat, barley, soy, sunflower shells, peanut shells and other materials. Alternative materials for timber like MDF board, Mica Laminates, etc. Industrial waste based blocks, aerated light weight BPC concrete blocks, Phospho-Gypsum based blocks can be used for masonry structures. Flu ash, for bricks, outdoor paving and in concrete. Putting these commodities into productive use saves resources and energy, reduce greenhouse emissions and contribute to a sustainable future.

Some of new materials that are developed include:

❖ Energy brick:

The energy brick fulfills all the criteria to save time and cost yet gives the maximum energy savings. It has high durability, high load bearing capacity coupled with highest in acoustic and thermal performance. A single brick is 600mm long× 300mm high×320mm wide and is equivalent in size to laying 18 standard clay bricks in double brick. It consists of a central core of rigid Polyisocyanurate Foam(PIR) with an external and

internal skin of 9mm Magnesium Oxide Board(non-combustible and form core self-extinguishing) making it both light weight, yet load bearing with attractive finish.



❖ Titan brick:

The Titan brick, a new building block made of 90% dirt that has been waterproof with non-toxic chemicals. The manufacturer, Titan Brick, Inc. of San Antonio, Texas, claims many advantages for its invention, beginning with high thermal mass and a high resistant coating of building made with Titan Brick by 50% or more. Advantages like fire resistance, mold and mildew resistant, involves less energy for production. It can be made with locally available dirt thus saving money for transportation and provision of employment to local workers. Each Titan brick weighs about 9.07 kg and is about 8” long by 8” wide and 4” tall.

❖ Recycled glass brick:

The GS 100 machine is designed to turn glass waste into sand grade sizes. The glass is then used to replace normal sand in brick making rendering the eco-bricks more eco-friendly over 70% of it being waste material. BEE cycle is currently researching a solution for glass waste by breaking down glass bottles into sand which is used to create eco-bricks for paving and construction.

❖ Green Leaf Brick:

Green Leaf Brick are newly manufactured fired masonry brick composed of 100% recycled materials, designed and engineered especially for the sustainable construction. In these carefully selected materials are processed sewage waste, recycled iron oxides, recycled glass, mineral tailings and other virgin ceramic scrap. These have properties like durability, high compressive strength, high acoustic performance, low chemical making, and fire protection.

❖ Marble- slurry brick:

Marble-slurry bricks are used as an alternative to conventional clay bricks. Its composition includes

Marble slurry (83%), Cement (7%), Sand (10%). The size of brick is of 230×115×75mm. It has many advantages like energy efficiency, fire resistance, avoiding plastering, high load bearing capacity, etc.

Compressive strength	93kg/cm ²
Water absorption	14%
Volume of brick	168705cm ³
Color	White/Grey

Table: 1 Properties of Marble-slurry Brick

❖ Thermo-Brick:

POROTHERM THERMO BRICK has borrowed the principle of thermal insulation from nature, to become a unique walling material-one that keeps the interiors cool in summer and warm in winter. It also has advantages like healthy living, strength and use, energy saving, fire protection, etc. The size of brick is of 400×200×200mm.

Compressive strength	≥3.5 N/mm ²
Weight	11.7kg
Density	731 Kg/m ³
U value	0.6 W/m ² K

Table: 2 Properties of Thermo-Brick

❖ Hempcrete:

An environmentally friendly alternative concrete to concrete, ‘hempcrete’ is made of hemp, lime and water. The material is eco-friendly and carbon negative due to the amount of carbon-dioxide stored during growing and harvesting of the hemp. Lime based hempcrete is estimated to have the potential to absorb and sequester 249kgs of carbon dioxide over 100years. It is unlike traditional concrete, does not produce large cracks under movement and can withstand earthquakes. Hempcrete has wide-ranging applications in architecture and building industries roofing, caulking, flooring, paint, cement, plaster, plywood, insulation, bricks and paneling. It is water-proof, fireproof and 100% recyclable and can also be used as fertilizer once demolished.

❖ Transparent Concrete:

Transparent Concrete is manufactured by using combination and fine concrete. These fibers blend into concrete like any other aggregates. These optical fibers can transmit light from natural and artificial sources into spaces enclosed by the translucent concrete panels. The main reason for using optical fiber in concrete is that it can transmit light even an incident angle greater than 60degrees. Transparent concrete is manufacture using fine materials only. It does not contain coarse

aggregates. This concrete can have the compressive strength of that high strength concrete around 70Mpa. The main advantages include energy efficiency. It is also called as Litracon or Translucent Concrete or Light transmitting Concrete.

Product	Litracon-Light Transmitting Concrete
Ingredients	96% concrete, 4% optical fiber
Density	2100-2400 kg/m ²
Block size	600mm×300mm
Thickness	25-500mm
Compressive strength	50 N/mm ²
Tensile strength	7 N/mm ²

Table: 3 Properties of Transparent Concrete

❖ Fly ash Bricks:

Fly ash Brick is a building material, containing class C fly ash and water. Compressed at 28 MPa and cured for 24 hours in 66°C steam bath, then toughened with an air entrainment agent, the bricks last for 100 freeze-thaw cycles. These are described as “self-cementing” as it has high concentration of calcium oxide in class C fly ash. The manufacturing method saves energy, reduces pollution, and costs 20% less than traditional clay brick manufacturing.

Material	Mass
Fly-ash	45%
Sand/stone dust	40%
Lime sludge	10%
Gypsum	5%
Total formula of material	100%

Table 4: Raw materials of Fly ash Acc Blocks

There are new products developed with the Fly ash as main component:

- Fly ash- sand- Lime-Gypsum Bricks:

It is used for walls and all types of building construction, boundary walls.

Size of brick: 230×115×75mm

Raw materials: Fly ash/ volcanic ash (60%), Sand (20%), Lime (15%), Gypsum (5%)

Compressive strength: 100-250kg/sq.mt

Silent Features:

- Eco-friendly
- Excellent strength
- Quick drying of bricks

- Reduced water absorption and shrinkage.
- Reduction in mortar consumption
- Utilization of industrial wastes and volcanic ash.

- Compressed Earth:

It is made of raw materials like soil with minimum 20% of clay and cement 5-10% depending upon strength.

Size of product:

Width: 220mm, 140mm, 115mm

Length: Flexible to make block from 100 to 240mm

Height: 115mm

Properties of product:

Compressive strength: 50-100 kg/sq.mt

Water absorption- 5-7%

It is mainly used for walling.

- Clay Fly ash Burnt Bricks:

It is majorly used for walls in building construction.

Raw materials: Soil (with minimum 20% clay), Fly ash, Sand, Fuel coal.

Size of the product: 230×115×75mm and is red in color.

Compressive Strength	75-150 kg/cm ²
Water absorption	12-18%
Unit weight	2.5-3 kgs
Bulk density	1700-1900 kg/cm ²

Table 5: Properties of Clay Fly ash Burnt Brick

- Advantages:

- Same number of bricks will cover more area than clay bricks.
- High fire insulation
- Due to high strength, practically no breakage during transport and use.
- These do not require soaking in water for 24hrs. Sprinkling of water is enough.
- Good sound insulation
- Saves construction cost and time.

IV. GREEN FLOORING

There is a wide variety of green flooring in the market place today. There are different types available:

- Finished Concrete Floors
- Linoleum and Vinyl Floors
- Bamboo
- FSC-Certified Wood Flooring
- Cork
- Natural Carpets
- Wall-to-Wall Carpets
- Tile
- Recycled Rubber Flooring
- Reclaimed Flooring

V. CONCLUSION

Fossil fuel is slowly depleting resource, world over. The use of fossil fuel can cause various effects. The green buildings encourage the use of reused & recycled material and discourage the use of virgin wood thereby, addressing environmental impacts associated with extraction and processing of virgin materials. Building materials consume a significant amount of energy right from the process of extraction of raw materials to the transportation to the construction site. Optimizing the usage and improving the efficiency, one can help in achieving major benefits, environmentally, financially and also socially. In India, the practice of efficient building has to be improved.

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