

# USE OF SUSTAINABLE CONSTRUCTION MATERIALS IN BUILDINGS : A STEP TOWARDS SUSTAINABLE DEVELOPMENT

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*Abstract— Today we are living in a globalized world where science and technology has made a drastic change in our life. Now human life is more comfortable than before. There are many resources used by man to form new materials and facilities. Construction materials are one of them which made many buildings, bridges, dams etc to facilitate human's life but simultaneously due to industrialization and urbanization a huge concerns about environment and health emerged. Development for present and future needs to protect available natural resources and environment so that they can be available for upcoming generations of human race. This is the key purpose of Sustainable development. In this direction the sustainable construction minimizes the production of waste produced by various construction sites and mitigates environmental pollution. Present paper was primarily emphasized to provide a theoretical background of various types of sustainable construction materials. It will be helpful to know about the uses of these materials also. Study is descriptive in nature and secondary sources were used for data collection.*

*Keywords— Sustainable Development, Sustainable Construction Materials, Green Building, Global Warming.*

## 1. INTRODUCTION

India is the second largest populated country of the world and population is getting increased day by day. It has caused many problems in each area of human development. We use various resources for the development and facilities to make life more easy and comfortable. Infact it cannot be deny that this development gave us many miracles but on the other hand this is only one face of the coin. If we see on another side, it will be found that we have lost many natural resources, on the sake of

development. Early it was realized by the world that this kind of development will lead to the complete depletion of natural resources and they will not be available for future generations. Then in 1987 a new concept of development i.e. sustainable development emerged. **Brundtland commission (1987)** stated that “**Sustainable development** is the development that meets the needs of present without compromising the needs of future generations to meet their own needs”. Sustainable development deals with three main aspects i.e. Environment, Economic and Social.

In the field of construction, we used plethora of materials to construct large buildings, dams, bridges, highways etc. but these materials caused directly or indirectly adverse effect on the environment also. The construction sector is one of the biggest contributors to climate change and buildings are responsible for much of the world's energy waste. Then a new concept of sustainable construction material came is existence which is now the urgent need of civil engineering. In the literal meaning of ‘Sustainable’ means ‘**long lasting**’ or which is viable for long time.

Sustainable Construction refers to the adoption of building designs, construction methods and materials that and environmentally friendly. It also means using materials and resources that have sustainable supplies and are readily available from many sources. The main purpose of the use of sustainable construction materials is to preserve raw materials, energy, water and other resources as well as to minimize the produced waste materials and pollution also. Some examples of sustainable construction materials are **bamboo, wood, hemp, wool, linen, clay, straw bales, timbercrete, stone, sand, bee wax, coconut** etc. As it is mentioned earlier that sustainable development has three main aspects so these construction materials are useful to enhance and promote sustainability in following ways

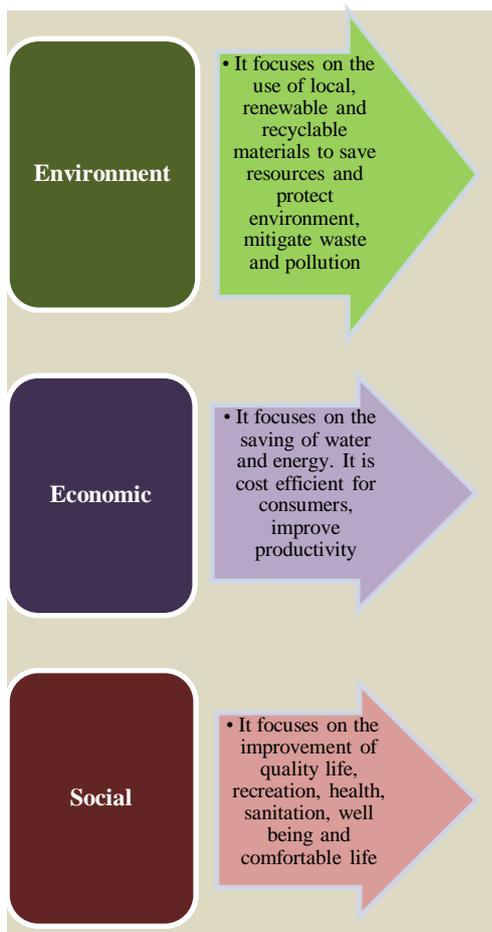


Figure. 1 Systematic Benefits of Sustainable Construction

Sustainable materials are of two types of sources -

1. **Renewable sources** - These are the materials from plant origin like wood, natural fiber etc.
2. **Reuse from the waste** - These are obtained by recyclable materials like old plumbing, doors, crushed glasses etc.

There are some features of sustainable construction materials as they are eco friendly, save energy, high durability and strength, reusable and recyclable etc. They have to be highly durable and can incorporate different technologies, such as **capturing energy, capturing CO<sub>2</sub>** while removing pollution. They are used when, in the long term, they have a **lower environmental cost than the natural materials**.

## 2. OBJECTIVES OF THE STUDY

It has following objectives -

- To know about the concept of sustainable construction.
- To study about the various types of sustainable construction materials.
- To discuss about the importance and uses of sustainable construction materials.

## 3. CONCEPT OF SUSTAINABLE CONSTRUCTION

At present the demand for a more sustainable way of building is today's requirement. It is an issue of eco-friendly environmental choice, and the sector has been now regulated for the purpose of implementing measures that improve the infrastructure's and building's environmental behaviour.

The **buildings consume 20 – 50% of the physical resources, according to their environment**. The building industry is a **huge consumer of natural resources** such as wood, minerals, water and energy. In addition, buildings, once built, continue to be a direct cause of pollution because of the carbonic emissions produced in them or their unhealthy effects on the earth. A **sustainable construction** takes account of the use of resources (energy, natural resources), their environmental impact and the specific risks to people's safety.

In building, **eco-friendly materials or green building materials** are those in which, for their production, placing and maintenance, actions of **low environmental impact** activities are performed. Sustainable buildings have to be durable, **reusable or recyclable**, include recyclable materials in their composition and these have to be obtained from natural resources or available local materials of the area where the building is to be made. These materials also have to be natural (such as **soil, adobe, wood, cork, bamboo, straw, sawdust**, etc.) and must not be spoilt by cold, heat or humidity.

Sustainable Construction has following objectives, which are key roles of it.



Figure. 2 Detailed Objectives of Sustainable Construction

#### 4. PHASES OF SUSTAINABLE CONSTRUCTION

Due to rapidly increasing population disposal of raw materials from construction site is a major problem of present it is not only harmful for environment but also affects the economy and society adversely. Sustainable construction provides a remedy for it as it possess three main phases –

- i) Before Construction Phase
- ii) During Construction Phase
- iii) After Construction Phase

All these phases can be summarized with the help of below flow chart – (Figure. 3)

#### 5. SUSTAINABLE CONSTRUCTION MATERIALS – RELEVANT FOR PRESENT AND FUTURE SCENARIO

There are many kinds of Sustainable construction materials. Some of them are as follows –

##### i) Wool Bricks -

These are obtained by the combination of wool (natural fiber) and natural polymer from seaweeds with clay. It has almost 37% more strength than normal bricks. It is weather proof also. It has no carbon content so it do not harm environment. These bricks have more strength than burnt bricks, they reduce the formation of fissures and deformities.

##### ii) Sustainable Concrete -

It is obtained by crushed glasses, wooden chips or slag. It is helpful to reduce the CO<sub>2</sub> emission from the building. It also minimizes the use of potable water and it can be recycled also. It is cheap and more durable.

##### iii) Solar tiles -

These tiles are prepared by photovoltaic cells. When sunlight falls on tiles, they produce energy for home by a strong electric field. These works like solar panels but form a part of the roof only. They are not bolted on the roof. These tiles are also known as solar shingles. They have high strength, durability and they are weather proof.

##### iv) Paper Insulation -

These insulations are made by the recycling of waste newspapers and cardboards. It contains borax, boric acid and calcium carbonate which make it insect resistant also. It can be used also to

fill the cracks and cavities of the wall. It has fire retardant feature also.

##### v) Triple glazed windows -

It is basically three layered glass windows which are completely insulated. Insulator that is used between the layers is Krypton. It is better than double glazed glasses as it has an extra pane of glass which makes it thicker and heavier also. They are resistant to condensation and reduce sound transmission. It is helpful in the minimization of energy consumption.

##### vi) Engineering Wood –

It is also known as composite wood or manmade wood or processed wood. It is made by the combination of strands, particles, fibers, veneers or wooden blocks with an adhesive. It is more stable and consistent. It has high flexibility and strength.

##### vii) Structural insulated panels (SIPs) -

SIPs are formed by two exterior structural boards adhered to a rigid plastic polystyrene foam core. These boards can be sheet metal, plywood, cement etc. These are most commonly being used in modular homes. It provides better insulation and strength but it is not as much as economical.

##### viii) Earthen materials -

It basically includes mud, minerals, rocks and water which have been used in construction since the dawn of the man. Now it is again being used in construction field because it can maintain the moisture for clean living environment. It is fire proof also as the safety point.

##### ix) Bamboo -

Now days, bamboo is also being used in building construction because it has high strength and low weight. It is a strong natural fiber so it is used in flooring, roofing, concrete reinforcement and walls. It can tolerate temperature till 400°C. it has excellent tensile strength and elasticity properties which make it more suitable in construction field. It is one of the fastest growing plants in the world so it can fulfill the need of availability of material. It has no danger to health.

##### x) Fly ash lime/Gypsum bricks -

These are made by addition of fly ash, lime, gypsum and sand. fly ash is a waste product of thermal power plants. These

bricks are much lighter than normal bricks but have a great strength. Plaster of Paris or gypsum plaster can directly apply on it. They do not need a huge amount of water for soaking only sprinkling of water is sufficient before use.

**xi) Timbercrete –**

Timbercrete is a blend of sawmill waste, cement, sand, binders and a non-toxic deflocculating additive, which is cured in direct sunlight and air, which convert into a unique building block/brick/panel or paver tile etc. It can be used for building construction, it is light in weight and durable.

urban solid ones can also be used as sustainable building materials. There are other original techniques, such manufacturing concrete with recycled tyre rubber; using the mud from sewage plants for making bricks, or wood and cork remains (**pruning, sawmills, sanding dust, etc.**), and especially **vegetal fibres (bamboo, coconut, etc.)** that, can be mixed with cement. These also work as insulators. Isolation renewable materials are completely recyclable and compostable, such as **cellulose**, which can be derived from newspapers or paper that are discarded. They cannot generate wastes and must attain the highest efficiency when regulating the temperature.

**7. CONCLUSION**

Use of sustainable construction materials is not our personal choice now; it is urgent need to save the natural resources as well as our planet. They perform good environmental impact as they are reusable and recyclable materials. Traditional construction materials are sometimes not as much economical while most of the sustainable construction materials are economical. They do not spread environmental pollution and facilitates the problem of disposal of waste materials. They are safe for health. Waste products are produced in very less amount to it. All these properties of sustainable construction materials put them in the category of environment friendly which will ensure our better future. Therefore use of sustainable construction materials in buildings will be helpful to step forward towards the achievement of the goal of Sustainable development which talks about the excellence and quality of human life and save our mother earth.

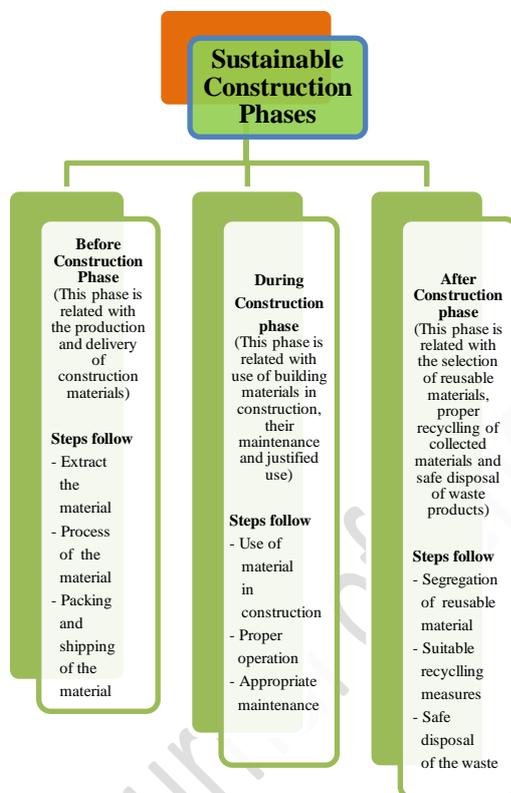


Figure. 3 Phases of Sustainable construction

**6. IMPORTANCE AND USES OF SUSTAINABLE CONSTRUCTION MATERIALS**

There is a reuse of wastes that are generated in other sectors for the production of building materials, such as **quarry wastes (marble, slate, etc.)**. Also, we have wastes generated by industrial processes like ashes or mud that are used, or the

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