

SUSTAINABLE CONSTRUCTION: THE NEED OF TIME

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Abstract

The purpose of this paper is to address sustainable construction material and technology, which refers to the adaption of building designs, construction materials that are environmental friendly. Through sustainable supplies material available naturally can be used optimally by reducing, recycling and reusing will reduce dependency on raw building material required for construction. This paper includes various components required for sustainable development and sustainable construction technologies and construction materials.

Keywords: sustainable, reducing, recycling and reusing.

Introduction

The building and construction industry plays vital role in economic, social and infrastructure development, which relies on conventional building materials and technology. The growing demand of these materials puts pressure on provision of requirement; and ultimately it leads to more generation, extraction and preparation of required materials by leading to environmental problems like deforestation, mining, land cleaning and clearing, blasting at mountains for extraction of stone and gravels leads to pollution and environmental problems. But on other hand sustainable construction enhances the resilience of building and construction materials and resources that are available from many sources in the world. It also means adopting construction methods that are environmentally friendly, faster, quieter and less labor intensive. And with sustainable construction, more materials can be readily recycled and reused for same or different purpose and this reduces waste, which is highly unlikely to decompose and degrade and promotes environmental sustainability.

Sustainable development and Sustainable construction

Sustainable development: Development that meets the needs of the present without compromising the ability and availability of the future generations meet their own need and demand.

Sustainable Construction: Sustainable construction is adaption of materials and

products in buildings and construction that will require less use of natural resources and increase the reusability of such material and products for the same or different purpose, thereby reducing waste. Sustainable construction also enhances the resilience of the industry; as such materials are readily available in the world. Steel, other metals, glass and prefabricated parts using combinations of these materials, as well as recyclable substitutes for concrete, and use of damaged fiber materials like wool, silk, sea-grass, sisal and old timber for flooring are the examples of sustainable materials and products. The use of sustainable materials and products is a part of the overall environmental sustainable effort. Sustainable construction can be factored into Green Mark for Building schemes in the future.

Significance of sustainable construction

- Enhances living, working and leisure environments for individual and for commodities.
- Consumes minimum energy for over its cycle.
- Generates minimum waste over its lifecycle.
- Integrates with the natural environment.
- Uses recycled materials
- Reduces CFC generated by various appliances
- Uses material, which is renewable in the short time.
- Provides natural and enhanced ventilation and lighting.
- Reduces water dependency on external supplies of water.

Incorporation of sustainable construction and techniques

- Sustainable construction starts with following aspect.
- Planning, design and specification
- Simple techniques can be applied to site planning to reduce the environmental impact and development costs.

It can be achieved by-

- Locating building footprints and foundation elevations to avoid watercourses and limit site disturbances of by excess soil excavation
- Incorporating natural systems and retaining the existing vegetation within site plan.
- Buy orienting building to take more benefits of solar design opportunities of passive lightening and solar heating.
- By incorporating natural ventilation practices to reduce dependency on electric appliances like air conditioners, fans and coolers.

Material conservation and selection of building material

- Use of building materials that requires less energy to manufacture and to maintain than traditional one.
- It can be achieved by using green materials and techniques to reduce environmental footprint.

It can be done by-

By implementation of renewable energy material.

- By reducing CFC.
- By using locally available material to avoid transportation.
- By installation of grey water treatment plant at site
- By incorporating natural lighting and ventilation
- By using recycled material like fly ash bricks, bamboo flooring.
- By using VOC free paints and plasters
- By using natural materials for exterior finishes

- Recycling of metal, glass and plastic material by remolding.

Waste minimization through 4R concept

- It is achieved by concept of 4R like reduce, reuse, recycle and recover waste material, which is highly non-biodegradable.
- It can be achieved by remolding material like timber, plastic, metal and glass.

Resource conservation

- It is done by installing various energy conservation features like LED lighting, direct lighting.
- Solar energy- by installing solar heater, solar photovoltaic panels, solar cooling, maximizing day lighting, natural ventilation systems, passive engineering techniques, improved insulation.
- Waste treatment- by installing biogas plant for sewage, by using grey water treatment units at domestic level.
- Rain water harvesting by roof collectors and by designing rain water collecting pervious layering garden or at open space near to site.

Water conservation features inside building. It is achieved by-

- By using recycled grey water for toilet flushing.
- Storm water collection in collection tanks.
- Leak detection at typical interval of time.
- Installing waterless urinals.
- Using an automatic controllers and rain sensors, soil moisture sensors.
- Using sustainable water treatment practices

Sustainable Construction Material

Sustainable building material-Sustainable building materials are defined as, Materials with overall superior performance in terms of specified criteria:

- Locally produced and source materials

- Processing and transport cost is minimum
- Provision thermal insulation
- Consideration of embodied energy
- Recyclability of building material and demolished building
- Use of renewable material and renewable energy practices
- Use of less energy consuming material through its life cycle
- Building structure should durable and weather resistant
- Promotion of ecological balance
- Aesthetically good appearance

Sustainable building materials

Following are the various green materials used for construction

- Wool bricks –These bricks are made by demolition brick material by simply adding wool or fiber material and waste polymers to clay bricks. These bricks are fire resistant and more resistant to cold-wet climate.



Fig. : Wool bricks

- Solar Roof tiles-traditional roofs are constructed by use of clay, concrete and other mined material to give good appearance, which are energy intensive. But solar roof tiles are integrated tiles, which protects inner side of structure from cold climate. These can be used as solar photovoltaic collectors to generate electricity by few modification collection panels



Fig. : Solar roof tiles

Sustainable Concrete-

Manufacturing of concrete and its utilization is responsible for building Co₂ emission due to poor insulation and ventilation, which leads to provision of artificial air conditioning systems. But most of the sustainable type of concrete is matrix of recyclable material like glass, timber parts, by products from steel industry and waste material from construction and demolition of old buildings.

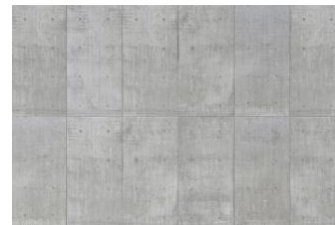


Fig. : Sustainable concrete



Fig. : Glazed window

- Copper-steel slag- application waste copper –steel slag in non-constructional material like wall, partition, decoration, framing of windows can reduce cost economy to purchase new material.

Triple Glazed Window- This type of window provides protection against wind and sunrays, but allows insulation through window to minimize heat loss.

Structural Framing- Steel or metal framing construction is efficient, durable but enables the implementation of Environmental Management Systems. Hence framing material made up of solid sustainable matrix materials like C&D

waste from old construction or renovation practices of an appropriate arrangement of slabs, beams and columns to avoid any vertical and horizontal loads on structure. Various types of such recycled material of I-section and H-section and hollow sections can be used as columns by filling it with other matrix concrete material to give strength the structure.



Fig. : Structural Framing



Fig. : Curtain walls

Dry internal Partition- besides the structural frame, various components of the building can be constructed by sustainable products for e.g. Use of plasterboards or fiberboard walls as internal partitions with provision of thick layer of sustainable plaster or concrete over it. The insulating materials can be use between two walls to avoid heat loss and acoustic and thermal effect.



Fig.: Dry internal Partition

Glass and cladding

Use of curtain walls, cladding walls and glass wall has replaced traditional masonry work. Curtain and cladding walls are lightweight external wall system that is hang on the building structure with incorporating use of spider legged stainless steel ,aluminum or other light weight components within tension-truss point to support the structure. In modern architecture it is characterized by, grids of glass, metal and granite or by combination together. Desired coating on glass walls can increase insulation of curtain walls. Use of photovoltaic panels with assembly of aluminum and other light weight allows ultimately reduced load on foundation and can be used as a solar collection panels. Use of curtain walls promotes natural day lighting system.

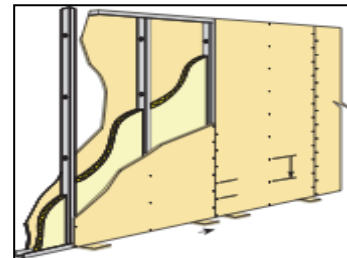


Fig. :Glass and cladding

Sustainable flooring

For Green Building material which is renewable by short time or other C&D material can be used for flooring like bamboo, palm, natural linoleum, recycled aggregate flooring.

Sustainable carpeting- For sustainable carpeting material naturally available can be used or C&D material from other building can be used. To promote such practices material like waste fibers from textile and wool industry and sea grass from costal regions is also a favorable option.

Wall Finishes- To give aesthetic appearance to wall during construction use of zero VOC paints, clay-alum plaster, hydrated lime plaster or lime paint can be used to achieve good insulation practices.

Cabinetry- To furniture internal door and partition and kitchen cabinetry, the use of

renewable material in shorter time can lead to saving of timber requirement.



Fig. : Bamboo flooring



Fig. : Recycled ceramic tile



Fig. : Sorghum cabinetry



Fig. : Bamboo cabinetry



Fig. : Clay plaster



Fig. : Recycled aggregate flooring

Case Study: Commercial building ING Bank Headquarter Netherland

ING House is constructed by ING bank to serve as the Banks Headquarter at South Amsterdam. The building resembles a large beetle in shining glass and anodized aluminum rest on ten-meter-high pillars constructed as table lying on 16 legs. The legs stand freely on pins in the large concrete blocks in the ground. The building is 28 meters wide, 138 meters long and at highest point of its 10 floors, 48 meters tall. The total site area is 5600m². ING House has lobby 250-seat auditorium, a foyer restaurant, more than 800m² of conference rooms and 160 parking spaces.

Steel and glass predominate the construction. Because of ample use of glass, building has great views and features. It has climate control walls which also ensures the outside noise is muffled and clean air comes in. this project has been awarded numerous prizes, including the aluminum Award the National Steel Award prize, The Glass award and the LON Award.

Due to ample use of glass and curtain windows structure promotes natural day lighting and in evening solar energy captured by photovoltaic cells is used for internal and external lighting. Triple glazed glass windows provides internal environment from heat envelope effect To avoid use of artificial air conditioning systems

total 6 inner gardens are constructed by using storm water collection techniques to avoid use of external water supply units. These 6 inner gardens promote continuous natural ventilation and exchange of heat transfer.

The external areas of building are constructed by provision of grass vegetation to avoid evaporation and to promote harvesting of water. Over all use of sustainable techniques in terms of energy, lighting, water and utilization of land this building promotes to sustainable construction and architecture.



ING Bank Headquarter (Ref: International journal of Springer- Sustainable)



Fig. : Inside of ING Headquarter(Ref: International journal of Springer- Sustainable)

Conclusion

Suitable building material by definition are materials available, produced or sourced which reduces transportation cost and CO₂ emissions,

these can include recycled material, they have lower environmental impact, these are thermally efficient, they require energy less than conventional materials, they make use of renewable energy sources like utilization solar energy, wind energy and waste minimization to limit the load on treatment facilities. Use of recycled material reduces load on waste handling practices.

Hence to control rapid rate of environmental degradation with respect to resource extraction and consumption; development in terms of 'Sustainable Construction' and 'Sustainable Architecture' will definitely provide a long lasting practices.

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