

Selection for buildings in cities:- Unit-6

(55)

Even though urbanization has many advantages in providing employment, economic growth, education, health care industry and technological development they are rising self-sustained.

The concept of development of cities where usage of land is reduced, ecology is maintained, urban sprawl is prevented etc. is called as smart growth.

The factors that are to be considered for sustainable site

- 1) The site should be rich in trees and biodiversity
- 2) It should be free from infectious diseases
- 3) It should not be located around slums.
- 4) The selected site should be free from pollutants, noise, wastes
- 5) Availability of smart transportation facilities.
- 6) Ease of availability of necessary needs and requirements nearby the site under consideration.
- 7) Diversity among the people and society i.e., people of different culture, class age-group etc.
- 8) Presence of agricultural fields and farm areas to facilitate availability of fresh, natural and nutritious food.

Practical Building Plan:-

1) Prospect:-

Prospect refers to be outside view of the structure when viewed through different rooms of the building. It also involves the hiding of any unwanted views in the outlook of the structure. Conflicts gets generated while considering both the prospect and aspect of the building and under this situation an architect must show his skills to overcome the conflict.

2) Privacy:-

It is an important aspect in planning a building. It is 2 types.

3) Aspect:-

Aspect is the terms used to describe the arrangement of doors and windows in the building such that certain amount of natural agencies like sunshine, breeze etc. should get admitted into rooms.

- 4) Circulation:- Circulation is the link between the different rooms and floors of the building so as to provide a means to access each with respect to other. Circulation in a particular building may be vertical or horizontal.

5. Flexibility:-

The Building should be planned by considering the future needs and requirements. The architect must prepare a plan such that stage by stage progress is attained when needed. The preparation of such a plan results in the smooth flexible process without any complication.

6. Requirement of Furniture:- The Building should be planned by keeping in mind the furniture requirement for a particular room. The plans of a room should also include layout furniture in it.

Characteristics of Bamboo housing system:-

a) Affordability:- foundations can be reduced, the thickness of non-load bearing wall panels is decreased. The basic components such as bamboo, bolts mesh, binding wire etc. - -

b) Sustainability and Impact on Environment:-

Bamboo is a Renewable Resource. It can be grown on degraded decomposed lands with in a short period of time. The usage of Bamboo minimises the usage of cement and steel. Bamboo can be protected using environment friendly materials.

c) Durability and safety:- The bamboo components effectively treated with safe preservatives possess a longer life. These by the structure are resistant to wind forces, earthquake forces and other imposed

d) Cultural Acceptability:-

The system produces all the environment friendly materials.

These fore the appearance is ethnic and gives a elegant feeling.

e) Improved Joining Technique:-

Splitting and nailing of bamboo cannot be done. The joints can be connected through boiling wire and strapping.

f) Modular Construction:-

Components such as roof trusses, in full grids can be designed by prefabricating or prefabricating bamboo on site.

g) Ease of Assembly:-

Basic skills like usage of tools in carpentry and masonry are necessary for construction.

h) Greenhouses:-

Bamboo helps in reducing carbon dioxide and generate 30% more oxygen than other trees and thereby help at the reduction of global warming.

i) Natural Water Control System:- Bamboo helps in prevention of water pollution due to its large extended roof systems. It prevents runoff and soil erosion.

With environmental and economic benefits. The Rating System has been introduced for developing Sustainable Building that is (56) ecofriendly conserves water, energy and natural resources in the construction and maintenance of the building, produce less waste and provide a better environment for its occupants.

The Green Building Rating System was started in 1990 in the United Kingdom and Refereed as the Building Research Establishment Environmental Assessment Method [BREEAM]. The main assessment criteria include innovation and design, management, health and well being, energy, transport, water, materials, land use and pollution.

The United States Green Building Council [USGBC] created the Leadership in Energy and Environmental Design [LEED] Green Building Rating System in the year 1998. The main assessment criteria include innovation and design process, location sustainable site, water efficiency, energy and atmosphere, material and resources, indoor environmental quality, awareness and education.

Green Globes is one of the leading green Building Rating System in United States, launched by the Green Building Initiatives in the year 2004. In Canada, the Green Globes System is operated by Building Owners and Managers Association [BOMA-Canada].

Japan Green Building Council [JGBC] Japan Sustainable Building Consortium [JSBC] was established in April 2003. It provides overall management of Comprehensive Assessment System for Building Environmental Efficiency [CASBEE]. The main assessment criteria of CASBEE are indoor environment, quality of service, outdoor environment on site, energy resource and material offsite environment etc.

Green Building Council of Australia created the Green Star Environmental Rating System to develop a sustainable property in Australia. The main assessment criteria include management indoor environmental, quality energy, transport, water, material land use and ecology, emission and innovation.

India has two Rating Systems to certify Buildings as green buildings. They are Green Rating for Integrated Habitat Assessment [GRIHA] and Leadership in Energy and Environmental Design.

IRIHA was conceptualized by the Energy and Resources Institute [TERI] and established under the ministry of new and Renewable energy government of India.

LEED-India; launched by the Indian Green Building Council [IGBC], is the Indian counterpart of United States Green Building Council's LEED. The key areas of assessment are sustainable site development, water savings, energy efficiency, material selection and indoor environmental quality.

Example: - Rajiv Gandhi International Airport [RGIA] in Hyderabad is the first airport in Asia to Register under United States Green Building Council's Leadership in Energy and Environmental Design New Construction [LEED NC] and awarded a silver Rating.

Green Building: -

Green Building is a building that is primarily designed or constructed to minimize negative environmental impacts further they are build in order create a positive impact on the environment.

Benefits of Green Building: -

- 1) Green Building is an eco-friendly type of Building which is constructed using Renewable materials.
- 2) It Reduces the negative impact and certain Positive impacts on the natural environments.
- 3) It Reduces global warming.
- 4) Green Building have green Roof system. It contains with Reduces Roof Building
- 5) Green-Roof system absorbs atmospheric Carbon-dioxide.
- 6) They also absorb sound noise and noxious Pollutants from atmosphere.
- 7) Green Building preserves Biodiversity and helps in maintaining ecological balance.
- 8) It improves the architectural appearance of the Building and Reduces energy consumption.
- 9) Green Building Requires less Investment and can produce more financial savings for future.
- 10) Green Building provides sufficient air circulation with proper ventilation.
- 11) It also Reduces the green house gas emission to atmosphere.

2) Durability

57

3) more economical

4) Aesthetic appearance

5) Resistant to mould and Fungus.

Reduce the heat gain of buildings using paints:-

The heat gain of buildings can be reduced by repainting as light colours reflect more sunlight than the dark colours. The surface reflectance is measured in albedo. The darker and rougher surface have a lower albedo. So to reflect the incoming solar radiation with light colours and apart from reducing the heat gain, the light coloured walls have longer life. White washing can also be done to maintain the interiors cool as white washed surface also effectively reflects the solar radiation.

Green energy management:-

Green energy management refers to utilization of alternative energy sources such as water, wind and solar energy to generate for use in homes, industries, and other purposes.

Characteristics of energy management systems:-

i) use of Renewable energy sources such as solar photovoltaics panels or wind turbines.

ii) Burning of municipal solid waste to produce electricity

iii) Encourage the use of low-emission Rental cars, taxis, Shuttles.

Green Building:-

The green building refers to a sustainable building that is eco friendly. Conserves water energy and natural resources in the construction and maintenance of the buildings, produces less waste and provides ambient environment for its occupants.

A conventional building use diff types of construction material such as sand and water from rivers, stones from the mountains cement prepared from material dug up from the land. The manufacture of construction material releases a large amount of carbon dioxide

- c) Reduction in waste water flow.
- d) Segregation of wastes
- e) Recycle or Reclaim wastes.
- f) Treat waste or Reduce Volume
- g) Delist wastes that do not have hazardous characteristics.

Examples of Toxic chemicals in industrial wastes:-

- 1) metals and organics such as cyanides that are generated in electroplating baths and APW out in waste water.
- 2) Polychlorinated biphenyls [PCBs] that are used as ~~trans~~ ^{transformers} and are existing in sediment on biota.
- 3) Ether such as 2-chloro ethyl [vinyl ether] from pharmaceutical wastes end up in water or sediment.
- 4) pesticides such as chlordane that are manufactured as pesticides and end up in sediment (or) biota.
- 5) Nitrosamines such as acrylonitrile in manufacture of plastics that end-up in water or sediment.

Ferro cement :-

Ferro cement is a type of thin Reinforced concrete construction in which standard Portland cement is mixed with plaster sand.

Alternate Roofing system preferred over conventional

Roofing system :-

The alternate Roofing system involves the use of metal roof tiles and light weight panel systems as these have many advantages.

③ structures are built only in the locations available on the with appropriate soils.

58

Types of Agro-based Resources :-

i) Forest Resources

ii) Agriculture Resources.

i) Forest Resources :-

Primary: Remains left out from logging and convention

harvest, obtained after land clearing in the forests

secondary: Pulping liquors, Residues from primary and secondary wood processing mill.

Tertiary: The left over part from demolition debris, urban wood processing, materials from wastes.

ii) Agriculture Resources :-

primary: grains, sugarcane, oil seeds, Perennial grasses, sugar beets etc.

secondary: Animal manures

Tertiary: Municipal solid waste and landfill gases.

Techniques in Industrial Waste Minimization :-

Waste minimization is defined as reduction of toxicity or volume of hazardous wastes that must be treated or disposed. Common techniques are:

1) change materials purchasing and control methods.

2) Improve house-keeping practices.

3) modify production methods.

4) less toxic materials should be substituted.

Various destructive elements that results in decay of timber

The decay of timber is caused due to various aspects

The various destructive elements the results in decay of timber are as follows.

- i) attack of bacteria and fungus
- ii) Improper seasoning of timber
- iii) loss of moisture content
- iv) imperfect storage or stacking
- v) vegetable growth.

Hollow Block concrete masonry:-

This type of masonry is used in the construction of domestic buildings. These are specifically used for an economical construction. The standard face thickness of these blocks should be less than 5cm and for the net area of about 55 to 66%. These hollow blocks are prepared by mixing of fine and coarse aggregate. They should possess resistance to water and in case they are not well resisted, blocks must be painted with water proof material.

Disadvantages of Rammed earth:-

- 1) More number of labour is required
- 2) It is a labour-intensive process
- 3) The process is expensive.
- 4) Buckets and hand rammers are costly.
- 5) Efficient tools are needed for mixing

[CO₂] that warms up the air and space.

(31)

By opting for green buildings over a conventional building we help to conserve our environment in the following three ways.

- a) The surrounding natural environment is preserved.
- b) Improvement in the internal environment for the inhabitants of the buildings.
- c) The ecofriendly building helps to preserve the environment at places far away from the building.

For instance, in order to accommodate thousands of people at a particular place, a multistoried complex has to be constructed in a fast area. The site for developing such multistoried structures should be selected in a manner such that the local vegetation with life, biodiversity and natural water bodies etc., are left undisturbed.

Features of a Green Building:-

A green building should have the following features.

1) Land

The design of the building should be in such a way that it should have sufficient green belt to provide good shade. The land surrounding the building should have plants and bushes that have mild but active fragrance.

2) Water

The natural water flow near the building should not be disrupted. Rainwater catchment devices can be installed on the roof to harvest the rainwater. The storage tanks store the rainwater which can be utilized immediately or directed into a borewell to replenish the water table. Other measures include installation of a drip irrigation system in gardens, plantation during water months, watering of plants in the early hours of morning and allowing the grass to grow taller in order to hold the soil moisture. Use of low-flush shower heads and low-flush toilets helps to conserve water. The greywater from kitchen and laundry can be treated and reused for watering the plants.

3) Energy

Non-conventional source of energy should be used as it is in great abundance and very cost-effective. It is an inexhaustible source of energy, does not produce greenhouse gases or contribute to global warming along with generation of local employment opportunities. Saving energy is utmost importance, for one, power saving means saving on endless power price hikes, and secondly, saving energy means saving our environment from unnecessary carbon emission. Energy can be

Conserved, for instance by replacing incandescent bulbs with energy-saving compact fluorescent lamps.

4) Light:

The interior lighting of the green building should be such that the occupants should feel as if they are in outdoor location

5) Air:-

Generally, the indoor air pollutants are carbon monoxide, nitrogen monoxide, lead, pesticides, household care products perfumes hair sprays air fresheners, moth repellents, tobacco smoke and biological pollutants.

All these pose a major threat to the health of young children and the elderly.

The indoor air quality in green buildings should be healthy and non-toxic indoor air pollution can be prevented with good hygiene and storage practices

6) Green wood:-

A research team at the Stanford university have discovered an alternate for wood by creating or seasoning hemp fibers and biodegradable plastic. The material was found to be as strong as wood and easily biodegradable.

Microbes can decompose the wood substitute and produce methane gas. The gas thus released can be absorbed by another type of bacteria. The plastic can be recycled to create a new wooden plan. Thus; this type of wood substitute helps to control deforestation and aid in the formation of rain-bearing clouds.

7) Green cement:-

The manufacturing of cement by conventional process releases a large amount of carbon dioxide which contributes to global warming. The scientists working with UK-India Education and Research Initiative (UKIERI) are developing green-cement with wastes like rice husk, flyash, lime stone dust, marble dust slag, quarry dust and paper mill. The new construction material can withstand adverse environmental impact.

8) Other sustainable materials:-

The group includes material consisting of Renewable Resources, locally available material durable and reusable or recyclable material.

Building Rating System:-

The Green Building Rating System is a non-profit organisation whose aim to effect methods of certifying construction projects

characteristics of good timber :-

(60)

- 1) timber should contain a uniform colour
- 2) It should give a sweet smell at a freshly cut surface
- 3) When timber is struck then deep and resonant sound should be produced.
- 4) The weight of the timber should be heavy.
- 5) It should not contain any flaws, blemishes, dead knots etc
- 6) The surface should present a bright appearance, with silky lustre
- 7) It should be more durable and dry elastic properly
- 8) The surface of the timber be hard.

objects of seasoning of timbers :-

- 1) It has a tendency to reduce or decrease shrinkage & splitting
- 2) maximum strength durability and workability is maintained.
- 3) It protects the timber from the attack of insect & fungi.
- 4) It maintain accurate shape and size of the timber.
- 5) weight of timber gets reduced and helps in easy handling & transport
- 6) Cost is reduced
- 7) It makes timber suitable for gluing.

Rammed Earth :-

Rammed earth is similar to sedimentary rock. The process of Rammed earth starts with the selection of soil. The selection of soil. The amounts of sand, silt and gravel in the soil selected for making Rammed earth should be in appropriate ratio to provide stability, cohesion and strength to the wall. Generally the soil used in construction of Rammed earth is taken from the construction site, moistened and then compacted to get a precise composition.

For a Rammed earth surface the ideal mixture consists of consists of 15-18% clay 23% coarse aggregate 30% sand 32% silt. In the traditional method, the sketch of the building is marked on the ground or foundation is to be constructed. The wooden forms of height 2 feet and length 6-8 feet are jointed at end panels. The thickness of the wall is generally $1\frac{1}{2}$ - 2 feet. The moist earth is rammed into the form and loose earth is laid in shallow layers of depth about 4-6 inches depth and then tamped with the help of a hard rammer [10 Pound weight]. The hard rammer is lifted to 2-2 feet then dropped on to the soil layers repeatedly. This gives more strength and weather resistance.

Advantages of Timber:-

- 1) It can be readily placed and sawn easily with simple machinery tools.
- 2) It is light in weight and can be handled without any machinery.
- 3) It is easily accessible.
- 4) It can be transported easily from one place to another.
- 5) It is good insulator of sound and heat.
- 6) It is more resistant to rotting and painting.

Disadvantages of Timber:-

- 1) It is easily combustible and cannot be eliminated.
- 2) Destructive hazards are created when framed buildings are constructed closely.
- 3) Timber gets damaged by the attack of fungi, insects etc.
- 4) Due to the change in atmospheric humidity timber may swell and undergo shrinkage.

Seasoning of Timber:-

Seasoning is the process of removal of moisture content from a freshly felled timber under controlled conditions.

Advantages:-

- 1) Seasoning allows timber to be easily painted, finished.
- 2) It prevents the timber from deteriorating its use.
- 3) The strength properties of timber gets improved by seasoning.
- 4) It provides dimensional stability.
- 5) The shape of the timber gets retained by seasoning.

Difference between Natural seasoning and Artificial seasoning

Natural seasoning	Artificial seasoning
1) The seasoning that is carried out in presence of open air (or) water.	1) The seasoning which is carried out artificially by means of machine.
2) It is a simple process.	2) It is a technical process.
3) It is inexpensive.	3) It is expensive.
4) It is a slow process.	4) It gives quick result.
5) More strength is gained by timber.	5) Less strength is gained by timber.
6) It resists the attack of insects.	6) It cannot resist the attack of insect.
7) More drying space is required.	7) Less space is required.

Lime-Pozzolana Cement :-

(61)

Lime-Pozzolana cements are capable of with standing the strike of aggressive waters and hardening in water, but because of their slow rate of hardening, lime-pozzolana are not being used. The total amount of lime to be combined with pozzolana depends on the following

- 1) Nature of active phases
- 2) Pozzolana content
- 3) Lime-Pozzolana ratio
- 4) Silica Content
- 5) Curing Period
- 6) Temperature
- 7) Specific surface area of pozzolana
- 8) Water-Solid Ratio.

Strength of lime-pozzolana increases as the combined lime content increases with the addition of KOH , $NaOH$, Na_2SO_4 , $CaCl_2$, the early strength and 28 days strength of lime pozzolana mixes can be increased. The 28 day strength should be greater than or equal to 30 MPa. The paste strength can be increased by the fineness of fly ash. After 4 months the strength of fly ash lime mortars increase to 40 MPa based on the water binder ratio, lime-fly ash ratio, curing condition etc. The high lime fly ash mix acts as hydraulic binders. To achieve the required strength the mixes are to be made with burned kaolin. Rice husk burnt under well defined conditions, can also be added to lime-pozzolana mix to obtain good and greater properties. The amount of rice husk ash to be added depends on the lime-pozzolana ratio. The attained strength of rice husk ash-lime-pozzolana do not increase beyond 28 days.

Characteristics of Lime :-

- 1) Lime is a calcium containing inorganic material which includes carbonates and oxides.
- 2) It has high strength and offer good resistance to moisture.
- 3) Lime can be moulded in to required shapes easily.
- 4) It have similar properties of cement and it can be mostly adopted for the masonry work.
- 5) Due to the high water absorption the shrinkage is less on drying.
- 6) Lime posses high workability and good plasticity.

1. Benefits of Lime: - During the manufacturing process of lime, it is burnt at lower temperature thereby saving fuel consumption and emission of pollution and green house gases. Thus, the amount of CO_2 produced is also low and it is 80% lower than in cement manufacture. CO_2 is also absorbed by lime during hydration process and made neutral over a period of time.

2. Recycling: -

- 1) It provides pleasant & comfortable room of construction.
- 2) Recycling of masonry materials is carried out at end of life.
- 3) It provides consistent quality and colour of mortar.
- 4) It needs less energy compared to the cement production.
- 5) It improves the quality of brick work and masonry work.
- 6) It maintains uniform mix proportions.

3. Performance: -

Lime is more workable and flexible than the cement mortar. In some circumstances, the movement joints are not necessary. It provides more accessibility which enable building to be more pleasant and comfortable.

Agro materials: -

The agro-based materials from Bamboos, Reeds, Sugarcane, grains oilseeds are harvested and used in the production of pulp, ethanol, agro-chemicals, biofuels, biomass, Biodiesel etc. --- These agro-based materials serve as Renewable energy sources and are sustainable. The edible like sugar cane, vegetable oil seeds are used in the production of methanol, biofuels and other agro-based resources.

Biomass is the material derived from forest woods, manures, micro-organism and aquatic plants. The Bio-mass is used to extract biofuels through direct combustion. Biomass is a carbon-based material. The plants perform photosynthesis process and this energy is stored in the Biomass. The energy generated is released into the atmosphere during combustion. Biomass is a carbon-based material. The plants perform photosynthesis process and this energy is stored in the Biomass. The energy generated is released into the atmosphere during combustion. The agro-based products set up. Carbon in the atmosphere. The use of waste materials decreases the landfill disposal and provides space for other things.

Industrial waste:-

Industrial waste Refers to solid, liquid and semi-solid waste material produced by manufacturing and industrial process. The industrial wastes are broadly categorized into hazardous waste. Hazardous waste includes heavy metals, cyanides, pesticides, complex aromatic compounds, toxic chemicals that are harmful to humans, plants and animals. The Non-hazardous industrial waste include Non-Radioactive medical waste, glass, aluminium foil, plastics, styrofoam, paper cardboard, plastics packaging, wood, textiles, rubble, scrap metal.

Impacts of Industrial waste on Environment and Human health

The impacts of industrial waste on human health and environment are considered as an important concern.

Some of effects are

- a) The waste water discarded from manufacturing or industrial processes contribute to water pollution.
- b) The toxic contaminants in water have found their way to animals, fish, birds and humans via the food chain.
- c) The toxic contaminants pollute the ground water supplies as well.
- d) The polluted water is unfit for drinking, recreation, agriculture and industry. The polluted water affects the reproduction of abilities of aquatic life.
- e) Pollution of air is created due to the greenhouse, ozone depleting substances, smog-producing substances and acrotoxic substances.
- f) change in the landscape patterns through illegal disposal and discharge of pollution leading to visual nuisance.
- g) changes in the soil fertility due to discharge of acrotoxic substances.
- h) Substances such as Cadmium, arsenic, chromium, nickel, dioxins, Bicyclic, Aromatic hydrocarbons (PAH) disposed at the landfill site are carcinogenic in nature. These substances further cause toxic effects on the nervous system, liver, kidneys, heart, lungs, skin, reproductive system etc. - - The other health problems include respiratory symptoms, irritation of the skin, nose and eyes, gastrointestinal problems, fatigue, headache, and allergies.

Measures to Control Industrial waste production:-

1) Reduction of waste at source:-

Some of the waste reduction techniques include.

- The product composition can be changed to reduce the amount of waste production.
- Minimize the use of hazardous materials that enter the production process.
- Technological innovations may be introduced to make changes to the process.
- Purchase of unnecessary items must be discouraged to avoid waste from unwanted materials.

2) Recycling of waste:-

- Processing and recycling of metallic elements should be done to avoid continuous mining.
- Waste material generated in an industrial setting may be used as a raw material for another process.
- The waste material may be returned to the original process.
- The packaging material can be reused.

Ferrrocement:- Ferrrocement is a type of thin reinforced concrete construction in which standard Portland cement is mixed with plaster sand. This mass is laid over many layers of wire meshes which acts as reinforcement.

Materials

Cement mortar matrix:-

The materials used are Portland cement & fine aggregates.
Mix proportions - sand cement ratio varies between 1.5 to 2.5
water cement ratio ranges between 0.35 to 0.45.

Reinforcement

There are two types of Reinforcements.

- Skeleton steel.
- Wire mesh.

In skeleton, the diameter of steel rod is 3-8mm at spacing of 70-100mm. Wire mesh contains galvanized wire of diameter 0.5mm to 2.5mm at spacing of 600mm centre-to-centre.

Properties:- 1) Ferrrocement has high crack resistance, ductility, impact.

- It consists of high strength weight ratio and helps in resisting cracks.
- Tensile strength is moderate, compressive strength is high.

Advantages:-

(63)

- i) The structure is thin and light in weight
- ii) It contains small simple construction techniques and there is no requirement of skilled labours.
- iii) Form work may not be necessary.
- iv) The damage caused due to impact loads can be easily repaired
- v) It is used in the manufacture of precast units.

Uses of Precast concrete:-

It is used in the construction of

- 1) Light and water tight structures
- 2) Water tanks
- 3) Silos and bins
- 4) Biogas holders
- 5) Pipes.
- 6) Folded plates and shell roofs
- 7) Modular housings.
- 8) Swimming Pools.
- 9) Permanent form concrete slabs.