A Mini-Project Report on

CONSTRUCTION OF ECO-FRIENDLY AND SUSTAINABLE BUILDING

Submitted in partial fulfillment of the requirement

For the award of the degree of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE, Permanently Affiliated to JNTUK, KAKINADA& Accredited by NBA)

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2019-2023

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This is to certify that the Mini-Project work entitled **"CONSTRUCTION OF ECO-FRIENDLY AND SUSTAINABLE BUILDING"** that is being submitted by **K. JAHNAVI** (19A31A0108), **G.N. SUDHA KAIVALYA** (19A31A0105), **K. KARTHIK** (20A35A0121), **R.SURYA SANJAY** (19A31A0138), **G. SWATHI RENUKA** (19A31A0106) in the partial fulfilment for the award of the Degree **Bachelor of Technology**, during year 2019-2023 in Civil Engineering of Pragati Engineering College, for the record of bonafide work carried out by them.

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ABSTRACT

Surampalem is a village in Rajavommangi Mandle, East Godavari district in the of Andhra Pradesh, the Environment of Surampalem is very warm. Owing to the increasing population needs, the construction activity is its boom, resulting in concrete structures and consequently decrease in green areas.

The climate of the area is quite warm during the months of summer with temperature reaching up to 40 degrees and more so proper care should be taken to avoid getting any kind of heat related ailment.

The concept of Eco-friendly and sustainable building has created an immense importance in a developing country like INDIA. The theory implies of minimizing the wastage and thecost of construction. With increase in urbanization the natural resources were used in improper wayswhich leads us towards the implementation of green buildings and the concept helps in making optimum use of natural resources. The green building is an eco-friendly component, since it is basedon the basic rule – "REDUCE, REUSE, and RECYCLE". Eventually, the green buildings affords a high level of economic and engineering performance, which leads us to the betterment of future generation.

Also the phenomenon of global warming or climate change has lead to many environmental issues including higher atmospheric temperatures, intensive precipitation and increased greenhouse gaseous emission resulting in increased indoor discomfort condition.

CHAPTER-1

INTRODUCTION

A green building also known as sustainable or high performance building is building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life.

To develop buildings which use the natural resources to the minimal at the time of construction as well as operation. Maximizes the use of efficient construction materials and practices; boosts the use of natural sources and sinks in the building's surroundings; minimizes the energy usage to run itself; uses highly proficient equipment for the indoor area; uses highly proficient methods for water and waste management. For Saving Energy Green Buildings emphasize more on natural lighting and concepts of temperature control and efficient design to further reduce the carbon footprint as well as reduce cost of operation

It is a "Green building" certified company from LEED and GRIHA. One is one of only buildings in India to be LEED rated and the first in the state of Maharashtra. It is also the only building in India with the highest ratings from LEED (platinum rating with 57 points which it obtained in 2010) and GRIHA (Five Star rating with 96 points).

Fig-1: Eco-friendly building outside view

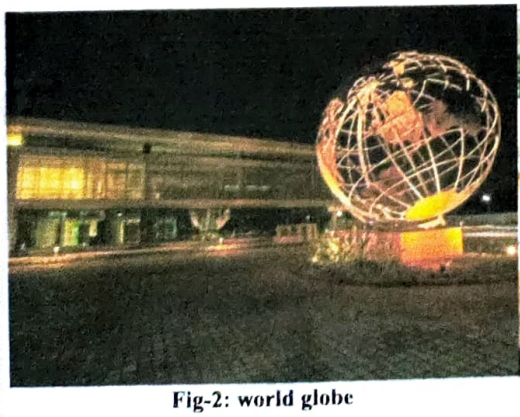


Fig-2: world globe

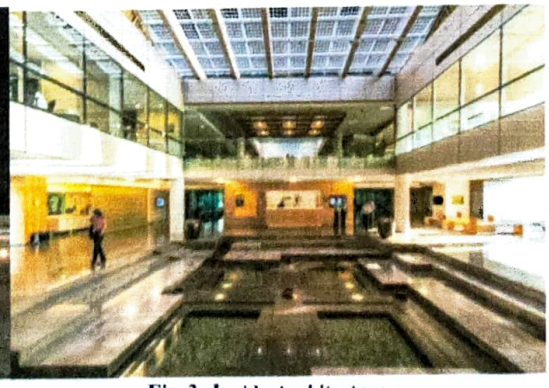


Fig-3: Inside Architecture

Green building

A Green building-also known as sustainable high performance building is building that, in its design, construction or operation, reduces or eliminates negative impacts and can create positive impacts, on our climate and natural environment.

'Better living for all and future generations' is a universal dream. With increasing urbanization, natural resources are being utilized rapidly and erratically without any planning and equivalentreplenishment. Green building is deemed necessary to fulfill the fundamental building codeterms and reduce its lifecycle environmental impacts and cost. The green building is an eco-friendly component, since it is based on the basic rule "REDUCE, REUSE, RECYCLE."Eventually, the green building affords a high level of economic and engineering performance,which leads us to the betterment of future generation.

Sustainability

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. A healthy, self-sustaining environment is what keeps the planet alive. The environment is the crucial life-supporting system for human existence and survival. It also provides the raw materials required for socio-economic progress. If properly managed, it can comfortably meet our socio-economic needs without undue strain on natural resources. On the other hand, if responsibly managed, the environment could easily become hazardous and threatening to rapid socio-economic development and human survival.

LEED Certification

LEED (Leadership in Energy and Environmental Design) is a globally recognized symbol of sustainability achievement and leadership. LEED is for all building types and all building phases including new construction, interior fit outs, operations and maintenance and core and shell.

The LEED rating systems are intended to be challenging in order to advance better designand construction practices. The rating systems are periodically updated to 'raise the bar' as theindustry catches up to these practices and as environmental challenges continue to grow. Although LEED certification is not intended to be easy, it is also not intended to prohibitive, costly or to be impossible to achieve.

LEED is readily achievable when teams initiate the discussion early, establish clear goals and organize the project in accordance with LEED process.

GRIHA Certification

GRIHA is an acronym for Green Rating for Integrated Habitat Assessment. GRIHA is a Sanskrit word meaning – 'Abode'. Human Habitats (buildings) interact with the environment in various ways. Throughout their life cycles, from construction to operation and then demolition,they consume resources in the form of energy, water, materials, etc. and emit wastes either directly in the form of municipal wastes or indirectly as emissions from electricity generation. GRIHA attempts to minimize a building's resource consumption, waste generation, and overall ecological impact to within certain nationally acceptable limits/benchmarks.

Going by the old adage 'what gets measured, gets managed', GRIHA attempts to quantify aspects such as energy consumption, waste generation, renewable energy adoption, etc. so as to manage, control and reduce the same to the best possible extent.

GRIHA is a rating tool that helps people assesses the performance of their building against certain nationally acceptable benchmarks. It evaluates the environmental performance of a building holistically over its entire lifecycle, thereby providing a definitive standard for what constitutes a 'green building'. The rating system, based on accepted energy and environmental principles, will seek to strike a balance between the established practices and emerging concepts,both national and international.

CHAPTER-2

LITERATURE REVIEW

- Ms. Rasika S. Bonde, Ms. Shubhangi S. Tope, Ms. Kiran R. Jadhav, Department of Civil Engineering, Pimpri Chinchwad Polytechnic (2018), from **"The Assessment of Green Building GRIHA rating tool and it's Implement"**, suggests that,

- A LEED Platinum and GRIHA 5 star certified building, One Earth is one of greenest corporate campuses in the world and the place where the team of Suzlon comes together from across the globe to work in harmony with nature and build a greener tomorrow, today.

- A million S.F. of ground plus two levels in a10.4 acre urban setting achieved a LEED Platinum and TERI GRIHA 5 Star certification with 8 percent of its annual energy generated on-site through photo voltaic panel sand wind mills with a total incremental cost ofabout11%.

- All other energy (4MW) is produced in the client's wind mill farms. With 92% (4MW) being consumed by the project is 'sustainable energy' making this a Zero Energy Project.

Mr. Shimone Samuel, Architect in Christopher Charles Benninger, Pune submitted **"The Renewable energy installed is SUZLON ONE EARTH Building"**, that some

of the strategies were adopted to reduce the impact of the proposed building on natural environment, those are:

- Sustainable Site Planning
- Passive architectural design strategies adopted in the building
- Renewable energy technologies installed on site
- Use of flow-energy/green materials
- Reduction in water consumption (compared to GRIHA benchmark)

CHAPTER-3

3.1 Sustainability in Eco-Friendly Building

The concept is not a new one, just one that was ignored and forgotten on our path to development and progress. The most widely quoted definition of sustainability states that sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.

Sustainability has become a wide ranging term that can be applied to almost every face of life on Earth, from a local to a global scale, and over various time periods. Long-lived and healthy wetlands and forests are examples of sustainable biological systems. Invisible chemical cycles redistribute water, oxygen, nitrogen and carbon through the world's living and non-living systems, and have sustained life for millions of years.

3.1.1 Sustainability Constructions

The construction sector has laid the benchmark for development since ancienttimes. Even today countries boasting the tallest and grandest buildings are considered to be themost developed. However, the growing economic disparities in developed countries, loss ofnatural resources, and there cent economic recession have served as eye-openers. People have realized that, contrary to long held belief, material wealth is not a reliableindicator of progress. A small country like Bhutan is actually one of the richest in the world when it comes to overall human development and the sustainable use of natural capital. Evaluate and assess buildings on a wide range of green attributes, several rating systems and standards have been adopted across the world by various bodies, including IGBC (LEED India) and MNRE (GRIHA) in India. These ratings systems are designed to evaluate not just new construction but also existing building structures, and are increasingly being considered by organizations with asocial conscience.

3.1.2 Vision of Sustainability in Building

Since its inception in 1995, Suzlon Energy Limited has worked to promote the cause of clean, renewable and sustainable energy in India. With a philosophy that emphasizes innovation to drive its every aspect, the company has turned the dream of a greener world into a sustainable and profitable business. The goal is to contribute to the world by creating sustainable social, economic and ecological development, and by using the very best technology to help mitigate the global climate crisis.

Suzlon has long held that development needs to be fundamentally sustainable to

be considered real and effective. For sustainable development, one only needs to look for the common, fundamental denominator for all human activity - energy. The acceptance of this reality is now universal, and is demonstrated in the commitment of nations and corporations to adopt renewable energy as a main stream source of power.

3.1.3 Working towards Sustainability

The Direction

Suzlon is committed to saving the planet for future generations; its corporate philosophy is 'powering a greener tomorrow'. So when Chairman & Managing Director Tulsi Tanti outlined his dream for a corporate campus, it was a given that what he intended was a completely sustainable campus. The idea was to create an ergonomically designed campus that would complement human scale and cater to all aspects of human faculty, emotional, functional and intellectual.

In his mind, the campus had to be simple, robust and minimal. The model that best suited the CMD's vision was a place with village- like characteristics such as proximity to nature, maximum use of natural light and ventilation, and neighborhoods that bond with technologically advanced facilities. Such a campus, he felt, would reflect the fact that Sustainability is at the core of the organization.

Sustainability being the guiding force, there were very definite directions for certain aspects of One Earth:

- Vastu Shastra, the traditional system of design based on directional alignments, was to play a very significant role in master planning, and the location of functions and services.
- Water efficiency measures were to be in coparated into the design.
- Architecture and architectural elements were to be designed to facilitate maximum use of natural resources.
- Provisions were to be made to ensure that part of the energy needs of the campus would be fulfilled by using natural energy generating methods such as wind turbinegenerators and solar panels.
- Optimized energy performance was to be facilitated.
- A Zero Waste Policy was to be initiated.
- Impact on the environment was to be minimized.
- Efforts were to be made to encourage use of green energy and sustainable practices with in the staff through implementation of green policies.

3.1.4 Social Sustainability

The concept of social sustainability encompasses human rights, labour rights, and corporate governance. It is based on the idea that future generations should have responsible access to social resources. The integrated project management team ensured that the One Earth project reflected the tenets of social sustainability fromconception to implementation.

3.1.5 Economic Sustainability

When we talk about economic sustainability it is not just about achieving economic growth year on year. More accurately, it involves understanding that economic growth is only sustainable if it simultaneously improves our quality of life and the environment.While long term savings are indeed a goal, what is more important is how those savings were arrived at, and the impact on the environment in the process.

3.2 A Legacy for the Future

3.2.1 Unique Sustainable Features

Sustainability was the main requirement of the brief for Suzlon One Earth, and obviously itwas one that was followed to the minutes detail. While innovative features were introduced at every stage of the project, there were some aspects that are unique to it and bear repetition. These are the features that distinguish Suzlon One Earth from other green buildings, and will be highlighted in any reference to this ambitious project.

3.2.2 Renewable Energy Integration-Turbines and Solar

Suzlon One Earth showcases a remarkable integration of renewable energy (RE) with the building design and landscape for a typical urban setup. With an installed RE capacity of over 150 kW, it signifies Suzlon's commitment towards environmental excellence in more than one way.

Suzlon One Earth has 18 wind turbines with a cumulative installed capacity of 85.5kW, located on 24 m high towers situated on the outer periphery of the complex. The solar modules have been strategically integrated with the CLC block roof and the terraces of A/B/C Blocks. This wind-solar hybrid system comprising five clusters of windmills and solar panels is able to meet 5% of the project's energy requirements. The implementation of a wind-solar hybrid system on an urban scale is a monumental task given the technical difficulties of locating the system, and the financial challenge posed by the long projected payback period of over 15 years.

Very few buildings in the country of this scale have such a integrated approach towards building design, site planning, and renewable energy.

3.2.3 Efficient Lighting Design

Making maximum use of daylight helps save a significant amount of energy. The 9- ft full height glazing coupled with a narrow floor plate - 79 ft in general and 59 ft in the Sun Lounge provide tremendous potential for daylight harvesting. This potential has been fully utilized by non-obtrusive placement of enclosures like conference rooms and the use of intelligent lighting controls. Cut outs along the periphery wall in the basement and a large one at the centre of the building cut down the need for basement lighting during the daytime.

CHAPTER-4

Understanding Eco-friendly and sustainable Building

One of the primary design objectives of Suzlon One Earth was to design a campus that was an exemplary example of being energy-efficient. Conservative use of energy, and energy production from renewable sources, are synonymous with a sustainable project. To achieve optimal energy performance it was necessary to create a building design that would reduce conventional energy demand and optimize energy performance of the building within specified comfort limits. To begin with, the baseline for minimum level of energy efficiency was established.

Fig-4: solar panels

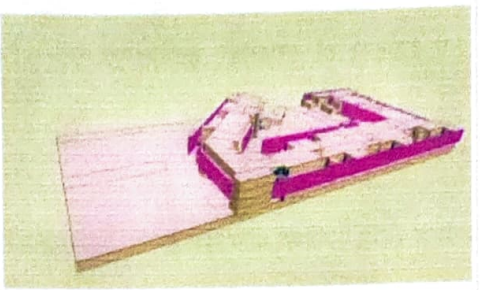
4.1 Electrical Design

The requirements in the electrical design brief were quite clear. What was needed was an electrical installation which was modular, scalable, flexible and reliable. Each of the office blocks were to be provided with independent distribution and metering systems. The initial design was for 5600 kVA connected load and 6000 kVA transformer capacity. However this was reworked to meet the company's initiative towards creating a low energy consumption building, and finally fixed at 3600 kVA with transformer capacity of 4000kVA.

The building envelope optimizes the thermal performance of a building. It reduces the heat load, and allows maximum daylight harvesting, thereby reducing the energy requirement of the building. The first floor largely extends over the ground, adding to the shaded areas.

The most effective shading is provided by the roof over hangs on the third floor, and external louverson the first and second floor, which provide100%shading.

4.2 Energy performance



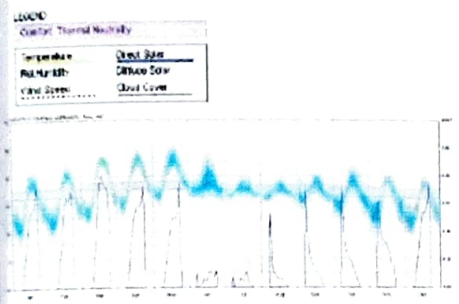


Figure 5- 3D View of the Corporate Office Block Simulation Model

Figure 6- 3D View of the Corporate Learning Center Simulation Model

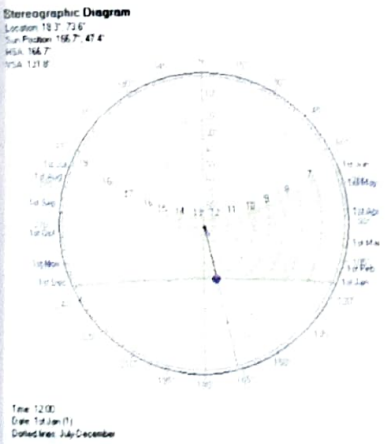


Fig-5, 6&7: The building has been evaluated using Visual DOE, a front-end to the DOE-2.1Eengineas the simulation tool.

HVAC(Heating Ventilation Air Conditioning)Systems The indoor unit's cooling operation offers flexibility to the user to control the desired temperature in any location in the premises according to individual preferences. Controls for switching on orswitching off, scheduling, temperature and air flow are possible for each enclosed space. Suchflexibility of operation based on users' needs curtails wastageand enables substantially higher energy savings than conventional systems. The space conditioning is applied in the following ways and space the Suzlon One Earth campus.

4.3 Water Efficiency

Water is one of our scarcest resources, and managing it efficiently is one of the most challenging tasks of any project designed to be sustainable. One of the most important goals of the One Earth project was to establish an efficient water management plan that included measures such as rainwater harvesting, and water recycling systems to ensure the use of 40%lesspotablewater.

Water Use Reduction

Water efficient fixtures and the use of captured rainwater and treated gray water (waste water generated from domestic activities) reduced water use by more than 50%. Conservation and water efficiency has been achieved by several different measures:

- Recycled gray water is used for flushing, irrigation, and HVAC.
- A Rain Water Treatment Plant and Sewage Treatment Plant have been installed on-site.
- Potable water consumption for site irrigation purposes has been reduced by 50% through high efficiency irrigation technology, use of recycled site water, and captured rain water.
- The landscape uses the concept of 'pebble drain' where all the excess water from the hard surfaces on the podium is drained onto a pebble drain. Drainage mats have been used below all the soft landscape areas on the podium to prevent soil erosion and to collect excess water.

Fig-8: pebble drain

The project has attempted to maximize water efficiency within buildings to minimize the burdenon municipal water supply by reducing the demand for potable water and reusing waste water. For achieving this, high efficiency fixtures that reduce the building's water useby20-30% havebeen installed, such as dual flush full (6 Lpf) and half (3 Lpf)- water closets, urinals with histrionic sensors, efficient flow plumbing fixtures, pressure reducing devices, and water conserving shower heads. Reusing storm water and gray water for non- potable applications such as toilet and urinal flushing, mechanical systems, and custodial uses has also been integrated in the services. An important measure that is unique to Suzlon One Earth is the efficient use of water during construction. Various water consuming processes during

construction such as tile cutting, cleaning of batching plant or curing of concrete structures were oriented towards the goal of using water efficiently.

Water Efficient Landscaping

With a large part of the campus given over to green spaces, water efficient landscaping was apriority. The goal was to limit or eliminate the use of potable water for landscape irrigation. High efficiency irrigation technologies were used in order to achieve this. Captured rain or recycled site water was used to reduce potable water use for site irrigation (except for initial watering to establish plants) by 50%.

Fig-9: Recycled Gray Water

A significant reduction in water consumption and landscape maintenance has been achieved through the use of patios, decks, shrub beds and groundcovers instead of water-sensitive lawns. The size of lawns has been reduced to the bare functional requirement.

- Placement of trees along with shrubs has been meticulously planned as has planting of shrubs and ground cover on all exposed soil surfaces.
- The landscape design uses mulching to aid plant growth, and to retain soil fertility and moisture.
- Aseasonalmaintenanceplanandintegratedpestcontrolplanhavebeenconceivedandincorporated.
- Losses due to inefficiency of irrigation are cut by the use of technologies like sprinkler and drip irrigation.

The resultant demand after the implementation of these measures is wholly fulfilled by non-portable sources like recycled graywater from S.T.P. or harvested rain water.

4.4 Working Comfort

It was the well-known British statesman Sir Winston Churchill who so aptly said, "We shape our buildings; thereafter they shape us." Today it is a well-accepted fact that human health, comfort and productivity are influenced by our built-up environment. A sustainable building enhances the indoor environment quality and working condition of occupants by providing them with greater exposure to natural light, creating a soothing effect on the mind,and maintaining.

Indoor Environmental Quality

A sustainable building is one that goes beyond mere material and building techniques to safeguard the quality of the indoor environment. An uncomfortable work ambience not only affects productivity and morale of the occupants, it also counteracts all the care taken to design and build the exterior envelope.

Indoor Air Quality

One of the main considerations is to ensure that the quality of indoor air is suitable for occupants of the building. Mechanical ventilation systems have been designed to allow 30%more fresh air to circulate indoors and augment the comfort and well-being of occupants. Thisis higher than the required standard. CO2 monitoring systems are installed in high density zonesto regulate inflow of fresh air through use of dampener sand the TFA Units.

Maximum potential occupancy load has been considered while calculating outside air in all spaces. Fresh air quantities have been calculated on the basis of 30% more than ASHRAE recommendations for office areas, and 100% fresh air for short occupancy areas including cafeteria, gym, lift lobbies and core areas.

Fig-10: High Density Zone

An efficient HVAC system and treated Fresh Air Units have been provided in the service cores at all floors. Fresh air monitoring devices in these units, and CO2 sensors through a BMS integrated scheme ensure that the planned fresh air in takes are maintained.

The purpose of Construction Indoor Air Quality (IAQ) Management is to reduce indoor air quality problems resulting from the construction process in order to help sustain the comfort and well being of construction workers and building occupants. The IAQ management planwascompletedbeforebeginningconstructionandincludedconstructionrelatedIAQprocedure sin pre-construction and construction progress meeting agendas.

The project adopted the SMACNA (Sheet Metaland Air Conditioning National Contractors Association) guidelines to prevent indoor air quality problems with regardto HVAC protection, source control, path way interruption, housekeeping, and scheduling.

Outdoor Air Delivery Monitoring

A monitoring system ensures fresh air intake quantities are maintained and when the conditions vary by 10% or more from the set point, it generates an alarm via the building automation system alarm to the building operator. The regularly occupied areas in theproject are conditioned by using a water cooled VRV system whose outdoor units are located on each floor in each block in a separate AHU room. Fresh air required for offices is pre- treated in fresh air treatment units.

The VRV system's Central Control Unit and the building's central BMS work in a co-ordinated way for outdoor air delivery monitoring. The field devices employed to maintain minimum ventilation requirements are:

- Modulating dampersat T.F.A.s(M)
- CO2 sensors within all densely occupied spaces (those with a design occupantdensity greater than or equal to 25 people per 1000 sq.ft)

Controllability of Systems

Lighting plays a significant role in human comfort – too much can be as disturbing as too little. Over 90% of the regularly occupied areas have been provided withindividual lighting controls. This gives flexibility to the individual and helps save power. Individual lighting controls have been provided for large cabin occupants and medium cabin occupants, and work stations have been equipped with task lighting.

Indoor Chemical and Pollutant Source Control

Special care has been taken to ensure that polluting zones such as toilets, copier rooms, etc.Where chemicals are used have deck-to-deck full height partitions with self-closing doors. Make-up air in all these areas is drawn from outside or adjacent occupied spaces. Special care has been taken to ensure that all exhaust locations are at least 25 feet away from fresh air intakes of air handling units.

Daylight

The daylight zone and prediction calculations from daylight simulation results demonstrate a minimum Daylight Factor of 2% in 75% of all space occupied for critical visual tasks. That means 75% of all regularly occupied spaces get adequate daylight, diminishing the need for artificial light and creating more natural conditions in the workspace.

Views

In order to improve productivity and have a positive psychological effect on employees 90%ofspaces allow access to the view outside. It is believed that access to a window that allows enough daylight and an outside view is beneficial to occupant and that it affects their satisfaction with their work space.

CHAPTER-5

DESIGN OF SUSTAINABLE BUILDING

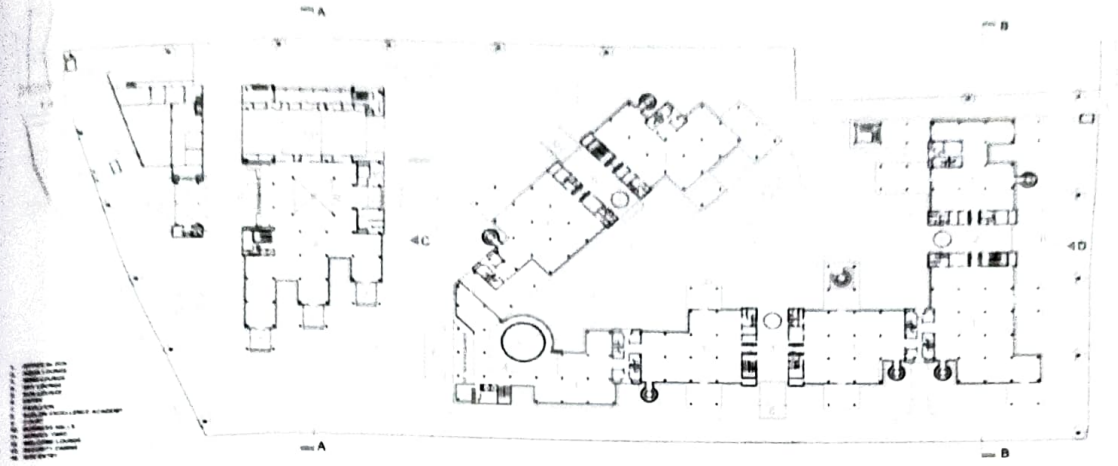
5.1 Choosing Site Location

Location is everything, and never more so than when planning a sustainable campus. The site for Suzlon One Earth was chosen after careful consideration to meet not onlythe physical requirements of the company but also all the criteria for a truly green project. Unlike Pune, this can seem a tall task, but Survey No. 170 of Sade SatraNalli at Hadapsar seemed to fulfil all the requirements. Opposite the well known Magarpatta City, the45,393sq. m. site had the advantage of being located within an already developed area, flanked by corporate offices and residential areas.

The main criterion was to seek a site on which construction would have the lowest environmental impact. Other criteria required that no buildings, roads or parking areas would be built on land that was prime farmland; or land with elevation lower than 5 feet abovethe elevation of the 100-year flood level; or land specifically identified as habitat for any species on the threatened or endangered list of the Wildlife Institute of India; or land within 100feet of any wetland as defined by local or state rule or law; or land which prior to acquisition for the project was public parkland.

It was important to the One Earth team to ensure that the site was located in an urban area with existing infrastructure, where they could also protect the existing biodiversity and preserve the habitat and natural resources. The chosen site was located within an existing minimum residential development density of 10 units per acre. It also had easy access to basic services such as a bank, place of worship, convenience grocery, day care, cleaners, fire station, medical/dental clinic, pharmacy, etc.

5.2 Planning



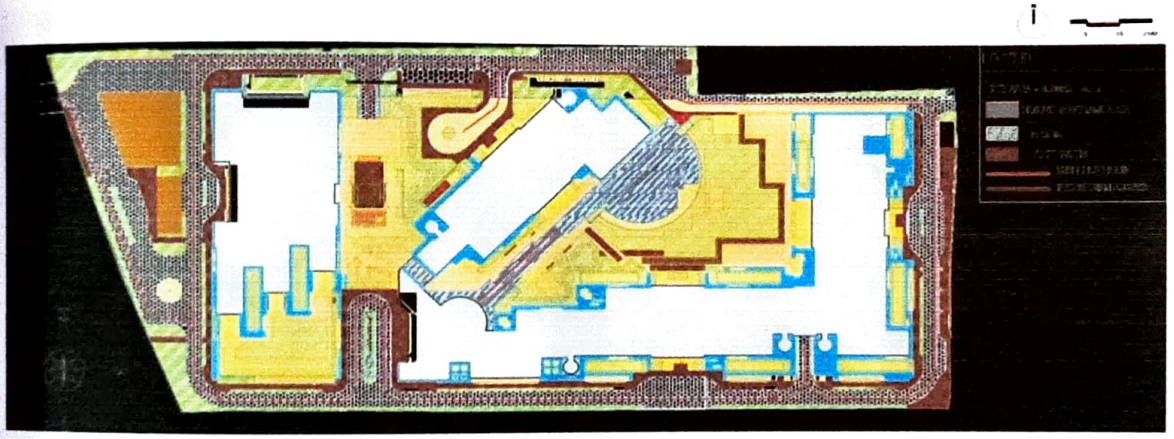


Fig-11&12:Building Ground floor plains

Design Approach

Spread over a sprawling 10.5 acres in Pune, the Suzlon One Earth campus was to be designed as per Sustainable Building practices. The entire design process of the campus, for both indoor and outdoor spaces, was to be created in a manner that would increase sustainability; in other words, improve the quality of life for Suzlonians while designing within the carrying capacity of supporting eco-systems.

The important considerations were to preserve and protect the landscape during construction; ensure soil conservation; include existing site features in the design; reduce hard paving on-site; enhance outdoor lighting system efficiency; and plan utilities efficiently. To ensure reduced site disturbance, One Earth was to be designed so that the open space exceeded local zoning open space requirements by 25%. This would help conserve existing natural area

sand restore damaged areas to provide a suitable natural habitat and promote biodiversity. As is required for Green field sites, site disturbance including earth work and clearing of vegetation, was limited to 40 feet beyond the building perimeter. The development footprint (refers to the entire building footprint, access roads and parking) were minimal to minimize site disruption. Clearly marked construction boundaries also helped minimize disturbance of the existing site and restore previously degraded areas to their natural state.

CHAPTER- 6

CONCLUSION AND RESULT

A green building with waterharvesting system utilize the natural energy to reduce temperature and increase ground water level. hence it will save the additional cost required for mechanical means to reduce temperature. We are living at a time when the earth is constantly being subjected to UV rays, global warming,and high level of pollution. The disaster is the unhealthy condition in our living. ECO-FRIENDLY AND SUSTAINABLE building approach is discussed will prove to be very beneficial giving effective result to reduce the extreme heat during the summer thus reducing energy consumption making the building sustainable providing the comfort level for the residents.

ECO-FRIENDLY AND SUSTAINABLE building with water harvesting system utilizes the natural energy to reduce temperature and increase ground water level hence it's a the additional cost required for mechanical means to reduce temperature. Its advantage can be summarized as stated below: It will absorb CO2 from atmosphere and reduces the greenhouse effect. The plantation will alsogive pleasant look to the building and surrounding areas. The collective effective of several buildings with green roof can reduce the —Heat islandl effect in urban areas, improve the air quality and reduce the dust and other air borne particles.

By providing green roofs, insulated cavity wall sand tiles on the outer face of the wall, we will reducethe indoor temperature about 50C to 70C. The rain water harvesting system will increase.Tiles on the outer face of the wall will reflect sun rays therefore reduce indoor temperature of building. By the provision of tiles on the wall, we will reduce yearly painting or distempering charges of the wall. Tiles protect the wall from the seepage during heavy rainfall. Though the concept of Green Homes in India is new, yet it will help us to put the first step forward in preservation of the earth's natural resources and cutting down on energy consumption and its cost.