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A STUDY ON GREEN BUILDING AND ITS POTENTIAL BENEFITS IN A VILLA

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Abstract- Green Villa refers to both the practice and product of creating buildings which are better for our health, environment and economy. Green Villa will be environmentally responsible and resource efficient throughout its life-cycle, as well as a sustainable and high performance building for economy, utility, durability, and comfort. The goals of the green villa are to, ensure a healthy, productive indoor environment for occupants to work and live, prevent negative impacts to our environment and improve its health, reducing operating cost and increase profitability for building owners **through energy and resource conservation.**

Keywords: Healthy, economical, comfortable

I-INTRODUCTION

Green Features of an integrated design approach includes building location and orientation, site preparation, energy and water efficiency, material selection, and indoor environmental quality. Green buildings will be a part of building healthy, sustainable communities for our future. Green building features include:

- Location near existing services.
- Natural lighting and solar energy.
- Excellent indoor air quality.
- Reduced or recycled content building materials.
- Green or vegetated roofs, walls and indoors.

II-GREEN ROOFS

Dark roof surface absorbs 70% or more the solar energy striking them, resulting in roof temperature of 65-88 degree Centigrade. These heat absorptions cannot break though green roof. Green roofs promote environmentalism which helps to solve the problems of conventional roofs. Green roofs support traditional vegetation without disturbing urban infrastructure. Green roofs are constructed in such a way to withstand extra load, to prevent penetration of water, extend moisture for plants even on hot days, impart drainage for plants, yield the soil to grow the plants. Green Roofs reduce the temperature by significant amount and it produces organic fruits and veggies.

III-GREEN WALLS

The green wall is either a free-standing or part of a building, covered with vegetation and in some cases, soil or an inorganic growing medium. They are also called as living walls, bio walls, or vertical gardens. The vegetation for a green wall is always on outside walls, but sometimes it can also be used in interiors During summer, walls cause rise in temperature increasing demand on cooling systems and consuming more energy. Green Walls reduces surface temperature by up to 10°C when covered with plants and moist soil. In 1979, Green Wall research by Akira Hoyano (Professor, Tokyo Institute of Technology), architecture revealed that the heat energy that passed through a Green wall is remarkably lower than a concrete wall. It also acts as a sound insulator, works as a barrier for noise and dust.

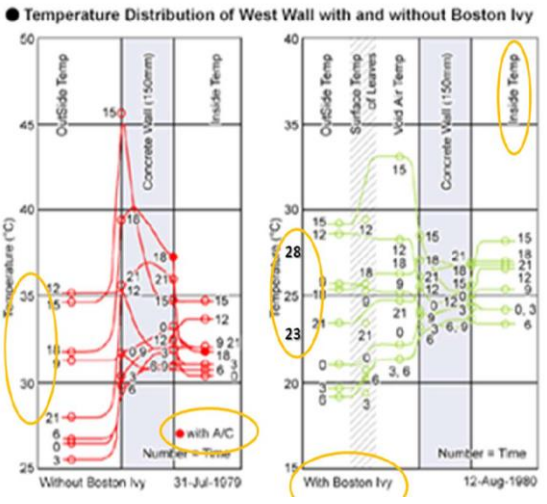

Fig 1: Comparison of temperature without and with Boston Ivy

III-BIO FILTERS

The Bio filter is a special type of green wall, known as 'Active living walls', which works in indoors based upon the science of bio filtration and phytoremediation. Bio filters increase the capacity of air filtration; they replace energy consumptive air filtration systems. Bio filter harness the natural phytoremediation capabilities by drawing air through the root system of the wall of tropical houseplants to effectively remove common airborne pollutant and the microbes degrade the pollutants in the air before returning the new fresh air back to the building. Pollutants in the air are absorbed by the vegetation and consumed by micro-organisms in the soil, improving air quality, harmful particulates and chemicals in air are attacked by biological components on the wall and are metabolized into a harmless state.

IV-SOLAR POWER

Solar panels contain photovoltaic cells that collect heat energy from the sun, this energy is trapped, and an inverter is used to convert the energy so that it is usable within your home to power things with electricity. Solar power is used to save money on electricity costs and supporting a healthier environment. Solar power depends upon, your sun exposure, roof, climate, even state policies can influence how well you'll do with a residential solar power system. The initial cost might be a bit high, but it makes more economic sense in the long run. This is a onetime expenditure that serves for the next thirty years or so. It is effective and people should feel comfortable that the technology itself has been proven as a reliable and clean energy source. With the solar panels facing in the south direction more energy is obtained out of the system.

V-RAIN WATER HARVESTING

Rainwater harvesting is the collection and storage of rainwater for reuse, rather than allowing it to run off. Rainwater can be collected from roofs, and in many places, the water collected is directed to a deep pit such as well, shaft, or borehole, a reservoir. It is used for gardens, livestock, irrigation, domestic use with proper treatment etc. The water collected can also be used as drinking water, long term storage, and for other purposes such as groundwater recharge. It is a simple method of self-supply of water for a house.

VI-WIND POWER

Wind turbines are generators that use the energy of the wind to produce clean and green power for individual homes. A home would require a small turbine with a 5-kW generating capacity to meet all its electricity needs. A turbine of this size has a diameter of 18 feet. The size needed to power a home can range from 2 kW to 10 kW (12- to 25-foot diameter) based on a home's energy needs. The payback period is 6 years. There are two types of systems used in wind turbines: one connected to the electricity grid called as on-grid and the other one as off-grid for battery charging or backup power. Many turbines are off-grid but the demand is rising for on-grid systems that use the grid as a battery i.e. when the wind blows the house uses electricity from the turbine; when winds are low and consumption is high, the house uses electricity from the grid. The wind turbines are used in conjunction with solar technology.

VII-PLANNING OF GREEN VILLA

The villa consists of a basement and a couple of floors above it. It is planned in such a way to accommodate all the green features.

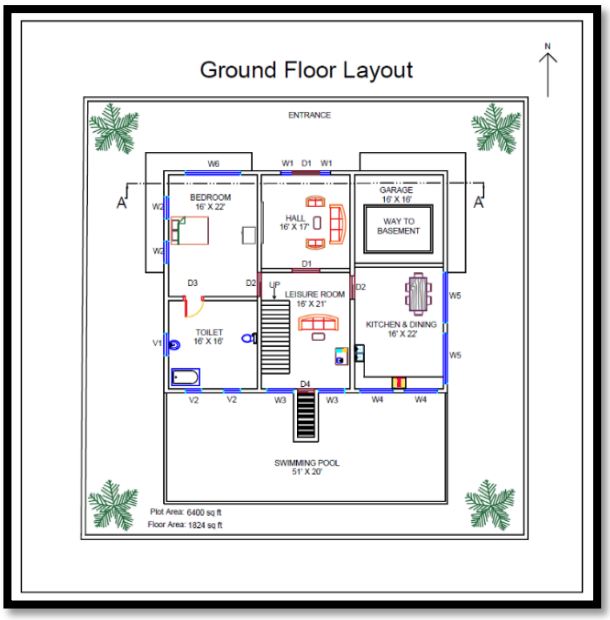

Fig 1: Ground Floor Layout

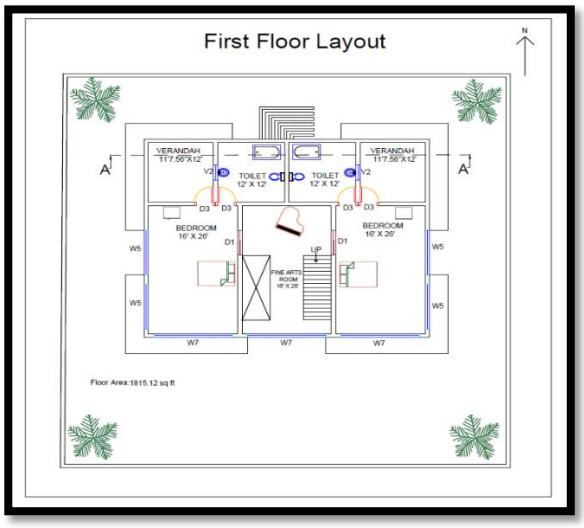

Fig 2: First floor layout

The total plot area is 6400 sq. feet and it is constructed on seismic Zone-II region in Madurai, India. The soil is clayey loam soil and so the consolidation is done with sand grain technique before construction.

VIII- STUCTURAL DESIGN

Multi storied building usually constructed for office, complex, apartments, hotels, hospitals, educational institutions, social centres, etc. these are either constructed using R.C.C or steel. Up to a certain height R.C.C buildings may work out to be more economical, but beyond this height, steel buildings are cheaper. Also, steel buildings are adopted where speed of construction is required. The following section with the analysis of the structure that is determination of the internal forces like bending moment, shear force, etc. in the component members, for which these members have to be designed, under the action of given external loads.

The framing of a multi storied building consist of columns, girders and beams which support roof and floor load. Such type of building frames is something called beam and column frame. The beam with supports the external wall is known as wall beam. A building frame may be considering a number of base and may have several stories. A multi storied, multi panelled frame is a complicated statically in determine structure. It consists of number of beams and columns built monolithically, framing a network. The doors and walls are supported on beams and columns. A building frame is subjected to vertical loads which consist of dead weight and live load as well as horizontal loads which consists of wind forces and earthquake forces. The ability of a multi-storied building to resist the wind 7 other lateral forces depends upon the rigidity of the connection between beam and columns. When connections of beam and columns are fully rigid, the structure as a whole is capable of resisting lateral force acting on the structure. The columns for multi-storied buildings can be fabricated for one, two or more storey. Columns may be continuous through two or three storey and the beam on each floor is connected to such continuous column on their sides. In order to achieve optimum utilization of column properties, the columns are arranged with flanges parallel to the long axis of the structure, since the traverse wind condition is the most severe. Foundation, required to take the super imposer loads on the columns, usually consists of rafts, piles or piers going deeper, harder, strata. Structural behaviour of multi-storied building subjected to lateral forces complex and highly determinate there are three recognized types of joints have no internal resistance against horizontal loads. In another way it is possible to provide lateral resistance with the introduction of vertical walls in proper locations. These are referred as diaphragms. Such diaphragm infill should be made of some structural materials of substantial stiffness of infill diaphragm will resist any changes to original rectangular shape of the frame.

X- ANALYSIS OF THE STRUCTURE

The analysis of the building is done by ETABS

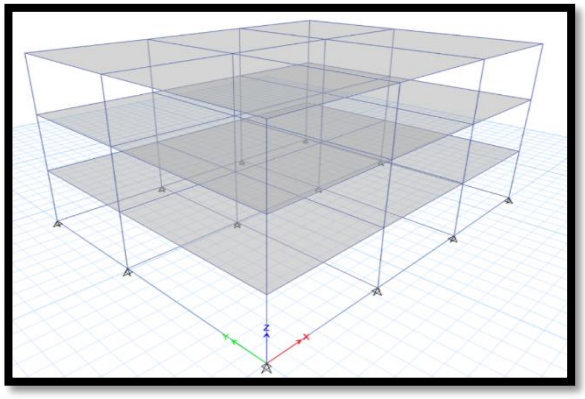

Fig 3: 3 Dimensional Structure

DEFORMATION

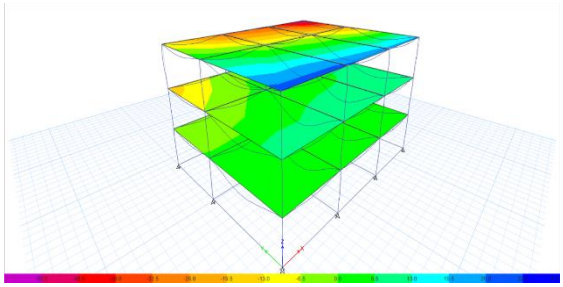

Fig 4: Deformed view

AXIAL FORCE

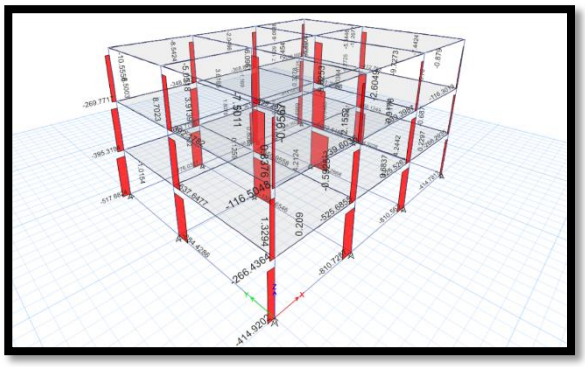

Fig 5: Axial forces on column

SHEAR FORCES IN BEAMS

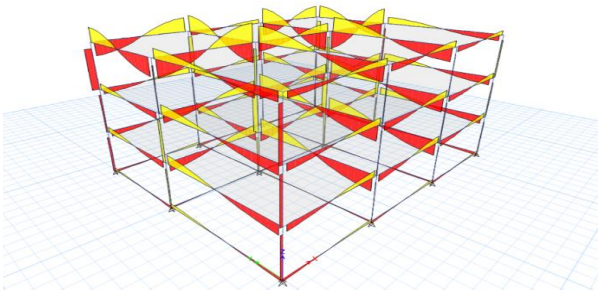

Fig 6: Shear forces in beams

SHEAR FORCES IN COLUMNS

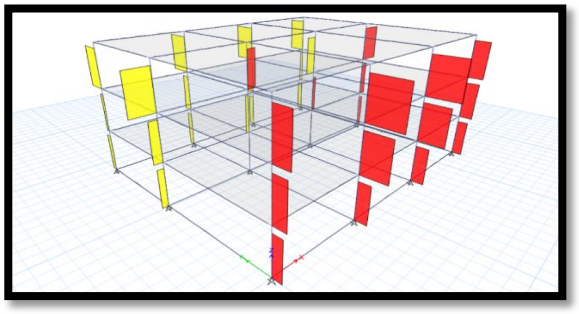

Fig 7: Shear forces in columns

BENDING MOMENT IN BEAMS

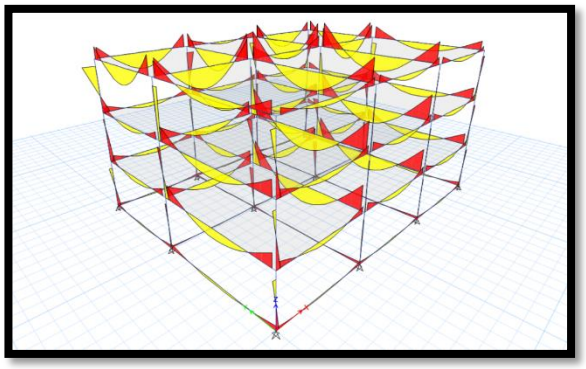

Fig 8: Bending moment in beams

BENDING MOMENT IN COLUMNS

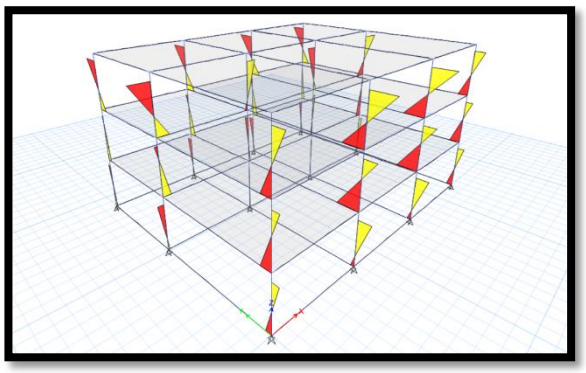

Fig 9: Bending moment in columns

X -3D RENDERING

3D visualization is created using two primary software's modellers and renderers. Rendering begins as a 3D model, which is represented by a series of flat geometric shapes connected together in three dimensional space. These shapes are called polygons which are the backbone of any digital 3D model, and are manipulated and created using computer software such as Rhinoceros 3D, Google Sketch Up, or 3D Studio Max. The models are represented in the digital space as a simple wire-frame object or scene, to give these shapes real form, they must be introduced to texture maps, artificial light sources, and a number of other filters that turn out to a finished 3D rendering. In addition

to modelling and rendering programs, there is also post-production software such as Photoshop that give each work the final aesthetic touches that are necessary for a rendering to be incredibly true to life. 3D rendering artists are a unique breed of artist, engineer, and mad scientist - experimenting on ones and zeros to get the most out of the technology currently available to produce their work.

XI- MODELLNG AND RENDERING OF THE GREEN VILLA

The proposed project is modelled using Google Sketch up 18 and it is rendered using Lumion Pro 8

XII-CONCLUSION

With advancing technologies time has come to move towards clean and green future, increased usage of fossil fuels have already caused enough global catastrophe and to build a better tomorrow for the generations to come the world needs to adopt sustainable development, nature should be taken care of and preserved. The world belongs to 8.7 million species and its time humanity takes its responsibility in protecting everyone and everything that belong to this great planet.

ACKNOWLEDGEMENT

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