

Modelling and Design of G+2 Residential Building with Integrated Green Design Concept

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Abstract — The purpose of our work is to emphasis on structural design of a building using green concept, so that the structure remains strong throughout its lifetime and capable enough to provide a shed during winter and summer. This concept minimises the demand of non-renewable resources and hence results in the use of resources that are eco-friendly, energy efficient providing comfortable and hygienic indoor working conditions. The focus of designing a green concept is to reduce the overall impact on human health as well as natural environment.

Keywords — Green Building, Efficiency, Sustainable Building, Analysis, Moisture Content, Plantation, Fly ash.

1. INTRODUCTION

In an effort to expand the vision of what is possible, the green building concept is to explore new and creative design solutions for Buildings. The entries provided creativity and thought provoking conceptual designs with innovative solutions. The Green Building model encourages all project adopters to build -green. This means implementing strategies that increases energy and resource efficiency and limit the presence of toxins. The Green Building plans provided on the following pages is G+2 storeyed with 6-bedrooms in it. Green concept is clearly a valuable concept for sustainable development as it relies only on natural air movement, and can save significant amounts of fossil fuel based energy by reducing the need for air conditioning. Reducing electrical energy used for cooling contributes to the reduction of Greenhouse gas emissions from the electrical generating plant providing the energy^[1].

2. PRINCIPLE BEHIND THE GREEN BUILDING

The principle for a green building has been carried out following up the modernization of the new age. We have implemented the idea of the green building as this improves the nature of the area and serves the locals with a beneficial product. The aim is to rule over the idea that more of the consumption procedures carried out; the more will be the benefits for the future.

The air has been polluted indeed by day to day works carried out during the process of construction. In order to solve this problem, we have presented our building

with the plantation or gardening over the terrace area for fresh air and enhanced aesthetic beauty.

The theme of our project highlights on the fact that this will hereby create healthier work, learning, and living environments by providing more natural light and cleaner a surrounding.

3. OUR WORK

In a society we demand better living conditions with maximum comfort. However, our increased energy consumption has far outweighed the improvement in conditions. We have forgotten what our forbearers taught us. Relying only on air conditioning to cool your home is as logical as running a refrigerator inside an oven. [2] The main aspect here is a Green Structure that holds an aesthetic beauty and durability in its life span. In this project, we have provided a plan with a total area of (108.676 X 148.0576) sq.ft. The planning has been prepared as per the location of the site and the idea that is topic related. We then proceeded towards the designing part that includes the design of slabs, beams, columns, footings and staircase with the help of IS Code book, i.e. IS 456:2000.

We aimed to create energy-conscious, healthy, and productive building that reduce or minimize the detrimental impacts of buildings on urban life and global environments.[3]

4. BLOCK DIAGRAM AND DESCRIPTION

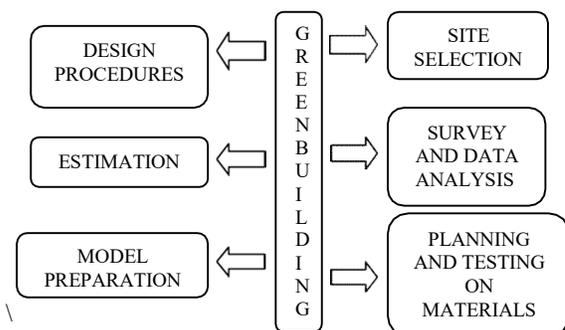


Fig.4.1 shows the block diagram. The above figure shows the block diagram and the descriptions of each block are described in the following points:

- Site Selection and Surveyed Data:** On the basis of the nature of the ground being selected

by us, we have prepared a contour map that shows us the geographical representation of the area near the volleyball court of our campus.

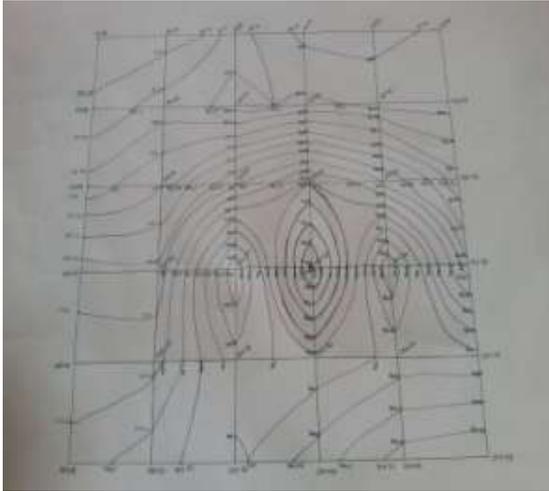


Fig.4.a.1 shows the nature of ground on a Contour Map

b. **Preparation of Plan:** We have prepared the plan of our building structure on how this will look in its appearance and its design when implemented practically. Our planning indicates the layout of a G+2 building with a staircase provided in it. We took the help of an AutoCAD design to present our idea into the plan.

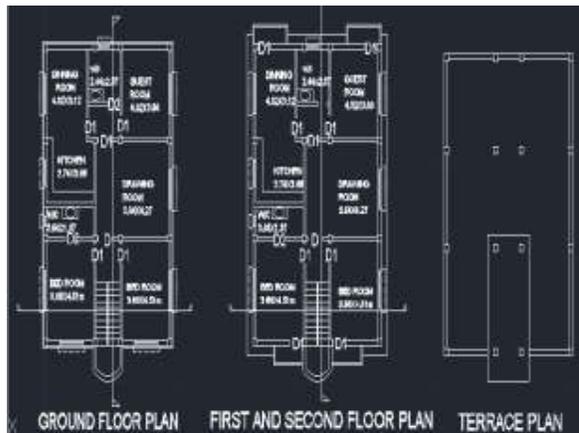


Fig.4.b.1 Plan of a Residential Building

c. **Material Test:**

We will perform different tests in order to see whether our building structure will remain safe in certain conditions or not. We therefore will be conducting tests to determine the optimum moisture content, soil bearing capacity, strength of concrete, bricks, etc.

Table 4.c.1 Optimum Moisture Content on Varying Blows

Sample No.	No. Of Blows	Wt. Of Sample (W-1)	Wt. Of Sample (W-2)
1	20	75 gm	30 gm
2	60	85 gm	20 gm

d. **Design Procedures:** We are following with the procedures for the design of slabs, beams, columns, footings and staircase as per the IS Code (Indian Standard Code). The procedure for analysis and design of a given building will depend on the type of building, its complexity, the no. of storeys, etc.^[4]

For our design of the structure, we are considering the limit state design method as the object of design based on the limit state concept is to achieve an acceptability that a structure will not become unserviceable in its life time for the use for which it is intended. I.e. it will not reach a limit state.

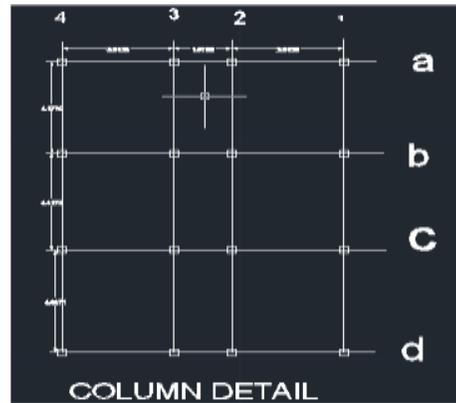


Fig.4.d.1 Column Details Of the Building Structure

e. **Estimation:** The main aim of estimation is to show the actual required amount for the initial stage of building construction till its finishing period. We will be preparing our estimation based on the same purpose while our construction work is being carried out in the future.

5. OPTIMUM MOISTURE CONTENT

The aim towards performing the test for optimum moisture content was to see soil compaction of the purposed area. Soil compaction is generally taken into consideration for support of knowing structural entities of foundation to improve their engineering properties such as, shear strength, compressibility, or permeability.

In case, the persisting soil obtains variable moisture content due to its shear pressure, the foundation soil may experience runoff or erosion. Hence, the laboratory test indicates the required soil density for the load bearing structure.

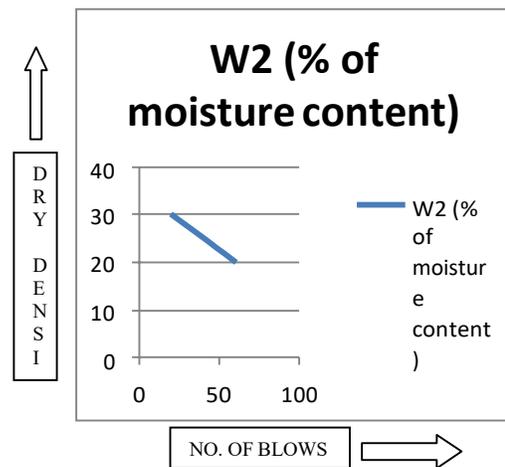


Fig.5.1 shows Optimum Moisture Content Graph

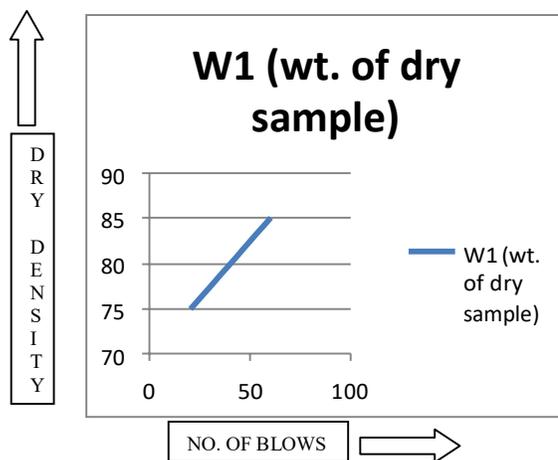


Fig.5.2 shows weight of dry sample Graph

The graph above shows the optimum moisture content of the soil i.e. the maximum dry density that

a soil possesses and the behaviour of the soil showing the presence of water content in it.

We performed the test with the help of a Casagrand's liquid device by giving it 25 blows closing the grooves. A maximum dry unit weight would be when zero voids are in the soil.

We took the soil from the site for the test and gave it 20-60 blows with the Casagrand's liquid device and then kept the soil into the oven in order to dry it. We then weighed the soil mass in the container and then calculated the required values. We then plotted the graph with the values we got after conducting the test.

6. MATERIALS USED FOR A GREEN BUILDING

Green or environmentally friendly materials can help create more sustainable, healthful, and ecologically sensitive buildings. This is achieved through environmental material assessment and green building specifications.^[5]

Our concept for construction of green building is also based upon the use of certain materials at the time of the building construction.

The materials purposed for our design are enlisted below;

- **Plantation over the terrace area:** We are adopting the idea on doing plantation or gardening over the terrace area that ensures a provision of aesthetic beauty and fresh air to all the living beings.
- **Interior Lighting:** We are going to prefer T-5 or T-8 tube lights with dimmer controls that is based on sunlight as this ensures the maintenance of indoor environment by minimum energy consumption.
- **Concrete:** Concrete being an excellent material for creating thermal mass, we also have used concrete to design our home as this regulates our home's temperature keeping it warm in winter and cool in summer.
- **Flyash Brick:** According to BIS, it is a proven fact that Fly ash bricks are 100 % reliable and long lasting than normal red clay bricks.^[6]

We considered flyash brick as this absorbs less heat than normal bricks and hence, most suitable for Indian conditions. This is also less porous i.e. absorbs very little water and keeps our building strong during rainy season.

7. ADVANTAGES

- [1]. The land area has been utilized for a good purpose and this improvises the aesthetic beauty of the college.
- [2]. Green or environmentally friendly materials help to create more sustainable, healthful, and ecologically sensitive building.
- [3]. Increases user productivity.
- [4]. Enhances image and marketability.
- [5]. This project also holds a good scope in near future.

8. ANALYSIS OF THE PROJECT

In near future, the demand for such a structure that is eco-friendly is highly appreciable and hence this will serve the locals with handful of advantages leading from vegetation to low utilisation of energy resources. Our work hence views Integrated Design Process as a process tool and a concept for management and organization of the green energy engineering process.^[6]

Taking this concept and carrying it forward, it has been found that implementing the idea of this project in a state like Sikkim will held the position of being a first G+2 residential building using Integrated Green Design Concept in the state.

9. CONCLUSION

The work can be done successfully. It is evidence that the Green Concept, for the building provides a sustainable structure throughout its intended life. These have the ability to save the environment for the future. The project as a whole results is a beneficial product to the locals around and the achievement of an eco-friendly structure. Also that sustainable solutions for green buildings can reach a higher standard and quality and are integrated earlier in the design process.^[7]

The future is seen green with goals and guidelines focused on necessity to develop greener products and also a contribution towards resource-limited planet earth. Beyond the obvious importance of safeguarding our environment and health, high performance green building will also benefit Sikkim's economy.^[8]

Future Scope

- This project builds the idea and a proper guidance in case any authority seems to have an interest in the topic.
- We can lead towards the path of an eco-friendly healthy environment.
- We can achieve an idea over the consumption of the different energy resources.

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