



DESIGN OF GREEN BUILDING BY USING REVIT SOFTWARE

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Abstract : The concept of Green Building has evolved to create environmentally sound buildings and reduce the overall impact on human health. Green buildings are designed to efficiently use energy, water and other natural resources to create a health conducive indoors and reduce the overall impact on the environment as well as non-renewable natural resources. To define Green Building and establish a common standard of measurement in India, the IGBC (Indian Green Building Council) developed Green Building Rating System from the LEED (Leadership in Energy and Environmental Design) Rating System. In addition, IGBC promotes whole building design practices, recognizes environmental leadership in the building industry, stimulates green competition, raises consumer awareness of green building benefits and transforms the building market into a more environmentally responsible entity. So, in this report the IGBC Green Building Rating System has been discussed. IGBC Green Building Rating System addresses green features under the following categories: Site Selection and Planning, Water Efficiency, Energy Efficiency, Materials, Indoor Environmental Quality, Innovation & Design Process. Methods and techniques under these categories have been discussed.

Index Terms - Green Building, Material Efficiency, Water Efficiency, Material Efficiency, REVIT, AutoCAD, IGBC.

1. INTRODUCTION

Green or sustainable building defines constructing healthier, more energy efficient and eco- friendly buildings. A Green Building uses less energy, water and natural resources creates less waste and is healthier for the people living inside compared to a standard building. If all the structures in the world are constructed giving importance to the ecosystem and energy efficiency, the harmful effects on the environment and the earth's eco-system such greenhouse effect, ozone layer depletion, global warming etc., can be prevented or minimized.



Figure 1. Green Building

2. OBJECTIVES

- Understanding the concept of Green Building.
- Design of green building by using software.
- Improve indoor air quality
- Implementing Rain Water Harvesting system with Ground Water Recharge as an attempt to improve regional Ground water table.

- Using eco-friendly and regionally available construction materials.
- Implementing solar panel for energy generation and reducing power consumption of building.
- Understanding Certification process and Guidelines of green building.

3. RESEARCH METHODOLOGY

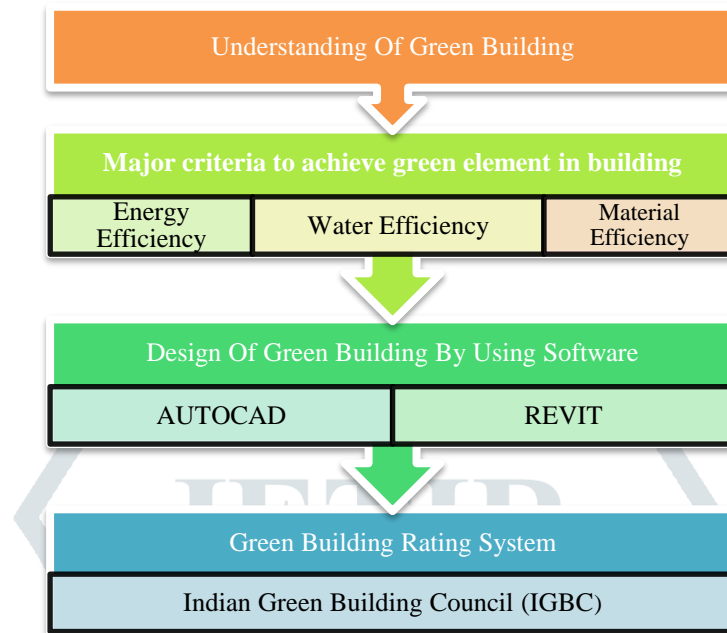


Figure 2. Methodology Used in Design of Green Building

4. MAJOR CRITERIA TO ACHIEVE GREEN ELEMENT IN BUILDING

4.1 Energy Efficiency:

Energy Efficiency can be achieved by, Using non-conventional and renewable sources of energy. Reducing energy consumption. Optimize energy performance. Use of alternative renewable sources of Power such as Solar Power, Bio mass, Wind Power, Hydro Power. In buildings, it is achieved by installing solar panels and photovoltaic, Solar water heater, natural lighting 6. and ventilation and by use of low consumption electrical appliances.

4.2 Material Efficiency

Material Efficiency can be achieved by, Using eco-friendly materials. Construction waste management. Use of regional and rapidly renewable materials. Use of wastes and debris of demolition works. Use of Compressed Earth Blocks, Fly ash Blocks, Stabilized Mud blocks, HVFC, Bamboo, Low VOC paints and other recycled and reuse materials. Use of Solar Reflective Glass and Low VOC paints for better indoor air quality.

4.3 Water Efficiency

Water Efficiency can be achieved by, Treatment of waste water and Recycling of Grey water. Water conservation and ground water recharge by Rainwater harvesting. Controlled water use and wastage reduction. Reducing storm water runoff by efficient landscaping.

5. DESIGN OF GREEN BUILDING

5.1 Software used

AutoCAD is globally used by surveyors, designers, engineers, drafters. This is used in architectural planning and Engineering Drafting.

Autodesk Revit is a building information modelling software for architects, landscape architects, structural engineers, MEP engineers, designers and contractors. The software allows users to design a building and structure and its components in 3D.

5.2 Design Steps:

- Open Revit software. Click on new button. Choose template file and click on ok and start the work.
- Firstly, import AUTOCAD file in REVIT for 3D Modelling.
- After that create levels (Height of one floor 10'6" and Height of headroom 8'.)
- After creating levels go to level 1 and click architecture tool and select wall (Wall size- 9")
- Go to location line and select exterior face option and start to draw only exterior walls.
- Go to level 2 then go to floor (thickness- 6"). By using line tool draw the boundary line to create floor.
- Again, go to level 2. select floor tool then select line tool to create floor for parking. (use offset for parking level- -6")
- For creating external ground floor wall select the exterior wall then copy and go to paste command option and select align to selected level and paste it on level 2.
- Go to properties tool and go to bottom constraints and select level 2 after that go to top constraints and select level 3 and make top offset 0 and click on apply for changes.
- For creating inner wall again go to level 2 to and click on wall command and draw the inner wall (toilet wall thickness- 4.5")
- For inserting door go to architecture tab click on door and then place the door as per drawing.
- For inserting windows go to architecture tab click on window and then place the windows as per drawing.
- For creating stair again go to level 2 and click on stair tool. Then select boundary and Go to modify tool and click on sketch and start to draw boundary of staircase.
- Then select riser and by using sketch tool draw the risers. After that select tread and draw the treads by using sketch tool and click on finish button for complete the designing of staircase.
- For creating 1st floor copy the complete ground floor and go to paste option and click on align to selected level and then paste it on level 3.
- For creating 1st floor slab firstly go to level 4 then go to floor then go to modify tool select line and draw the floor. For creating headroom go to architecture tab and select wall to and draw the walls of headroom as per drawing. And then place the window and door for headroom by using architecture tool.
- For creating headroom slab go to level 5 then click on floor and go to modify tool and select rectangular to draw the slab.
- For creating parapet wall go to architecture tab and use wall tool. (height-3')

5.3 Plan and section

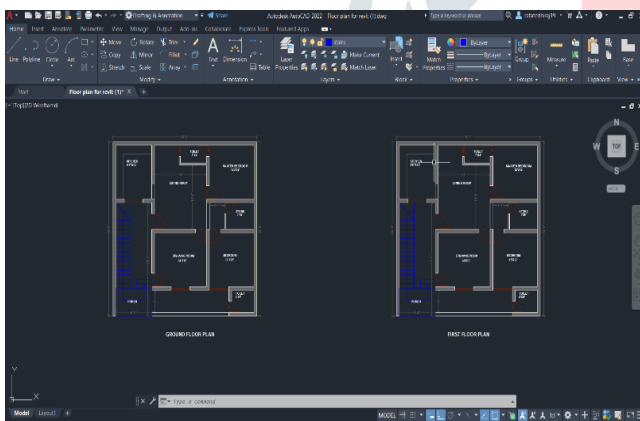


Figure 3. 2D Plan

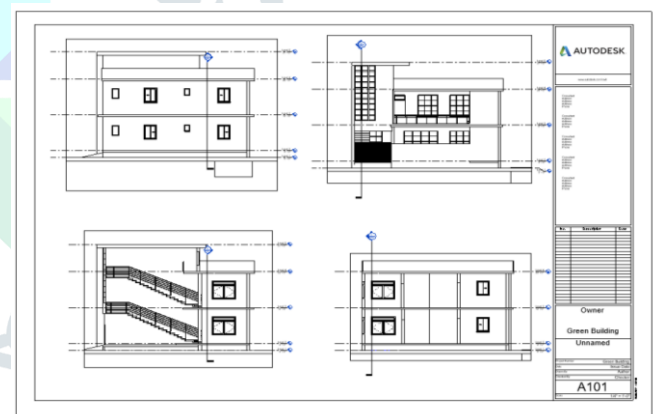


Figure 4. Elevation and Section

5.4 3D Views

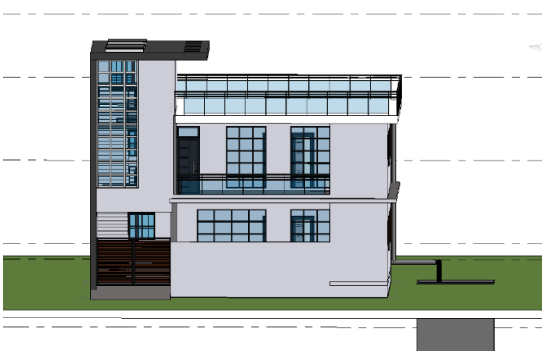


Figure 5. Front View

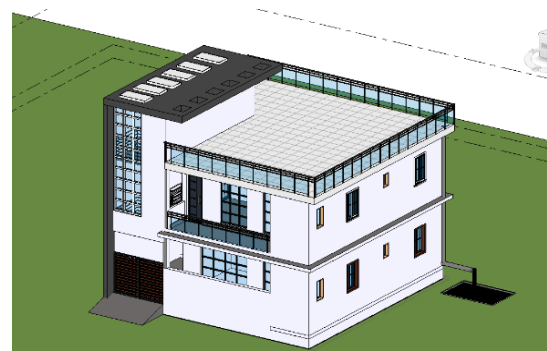


Figure 6. Top View

5.5 Technology Used

Rooftop Rainwater Harvesting

In rooftop harvesting, the roof becomes the catchment, and the rainwater is collected from the roof of the house/building. In Model we used Flat terrace as a catchment area and rainwater falls on roof terrace is passed through pipe to percolation tank in order to increase groundwater level. PVC Pipes is used for transportation of rainwater and it is UV resistant. Percolation Tank is 2m wide and 3m deep. Top of the pit is completely covered and the bottom of the pit is filled with filter media.

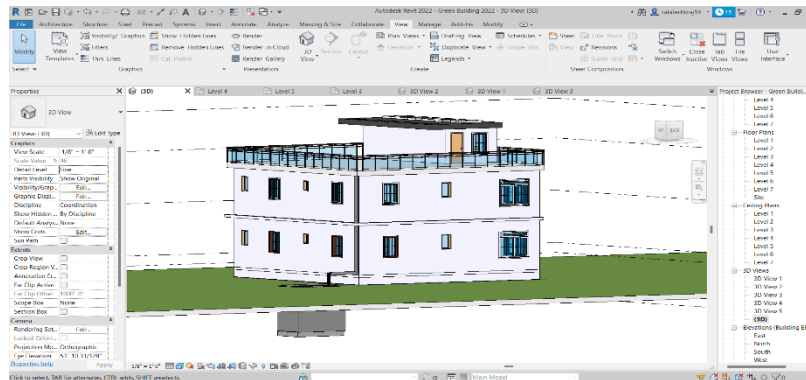


Figure 7. Model showing Rooftop Rainwater Harvesting

Cool Roof Tiles

Cool roof tiles are made up of natural occurring white minerals which having high solar reflectance materials to reflect the sunlight which falls on the roof. In Model, we used LUNE Tiles as cool roof tiles. It has high Solar Reflectance Index. It is lightweight, eco-friendly, high strength and heat resistant.

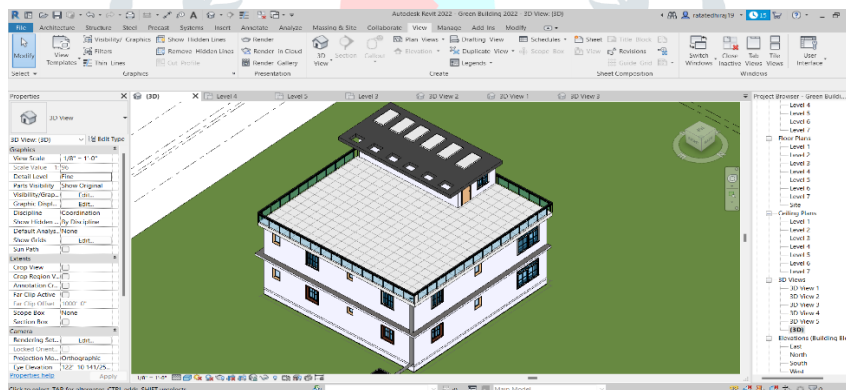


Figure 8. Model showing Cool Roof Tiles

Solar Reflective Glass

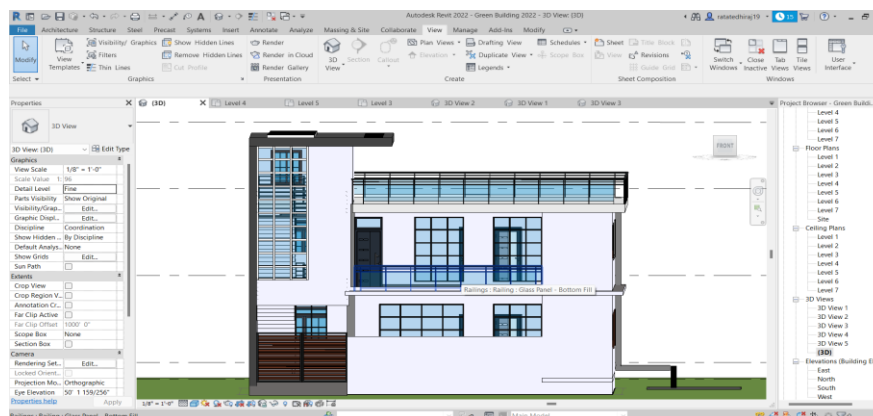


Figure 9. Model showing Solar Reflective Glass

5.6 Material Used

Fly ash Blocks

Fly ash Bricks are feasible because, they are eco-friendly, easily available, economical. Blocks are hollow hence reduces load on structure and provides insulation to walls. Fly ash block is twice as big as compared to 1 ordinary brick

Table 1. Cost comparison of Fly ash Blocks and Standard Brick

Standard Brick 1st Class (190X90X90mm)	Fly ash Blocks (190 X90 X 390mm)
Rs.10 per brick	Rs. 22.5 per block

High Volume Fly Ash Concrete

HVFC is feasible because Fly ash is cheap, easily available and best suited as a filler material in concrete. HVFC are more economic when compared to Ordinary concrete

Table 2. Cost comparison of HVFC and Ordinary Concrete

Grade	Ordinary Concrete (Rs.)	HVFC (Rs.)
M-25	3750	3150
M-30	4230	3570

Solar Reflective Glass

These Glass are feasible because they control the infrared rays of sun keeps indoor environment cooler than outside. They are expensive than ordinary glass but still economical if the expenses of electricity for Air conditioning are also considered.

Table 3. Cost comparison of Ordinary Glass and Solar Reflective Glass

Ordinary Glass	Solar Reflective Glass
Rs. 30-35 per Sq. ft	Rs. 40-45 per Sq. ft

6. IGBC GREEN NEW BUILDING RATIONG SYSTEM

IGBC has set up the Green New Buildings Core Committee to develop the rating programme. This committee comprised of key stakeholders, including architects, builders, consultants, developers, owners, institutions, manufacturers and industry representatives. The committee, with a diverse background and knowledge has enriched the rating system, both in its content and process.

IGBC Green New Buildings rating system addresses green features under the following categories:

- Sustainable Architecture and Design
- Site Selection and Planning
- Water Conservation
- Energy Efficiency Building Materials and Resources
- Indoor Environmental Quality
- Innovation and Development

The guidelines detailed under each mandatory requirement & credit enables the design and construction of new buildings of all sizes and types (as defined in scope). Different levels of green building certification are awarded based on the total credits earned. However, every green new building should meet certain mandatory requirements, which are non-negotiable.

The threshold criteria for certification levels are as under:

Table 4. IGBC Certification Levels

Certification level	Owner-occupied Buildings	Tenant-occupied Buildings	Recognition
Certified	40-49	40-49	Best Practices
Silver	50-59	50-59	Outstanding Performance
Gold	60-74	60-74	National Excellence
Platinum	75-100	75-100	Global Leadership

7. CONCLUSION

With the convergence of urbanization, globalization and rapidly changing and expanding economy, using these green building concepts will help the world as well as India in satisfying the shortage of valuable resources and also will prevent environmental degradation. Thus, Green building provides significant return on investment to contractors, architects and building owners.

The aim of the project was to understand, plan and design of Green Building. That has been achieved by studying different green technologies for buildings. By planning and designing building layout, development of plan, elevation, sections etc. Various Green technologies and materials proposed with their feasibility study. The structure of the building is designed using AutoCAD and REVIT software. And finally, a self-assessment is also done by considering IGBC certification standards.

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