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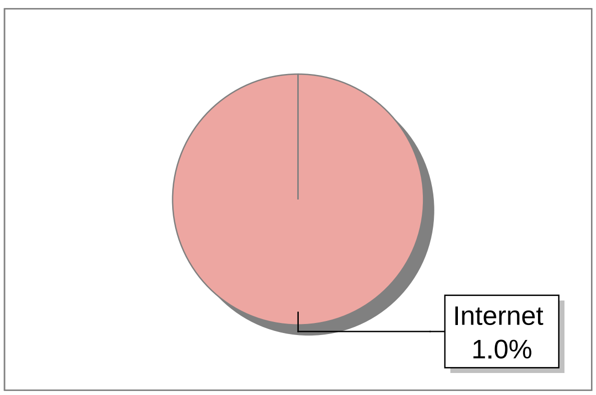

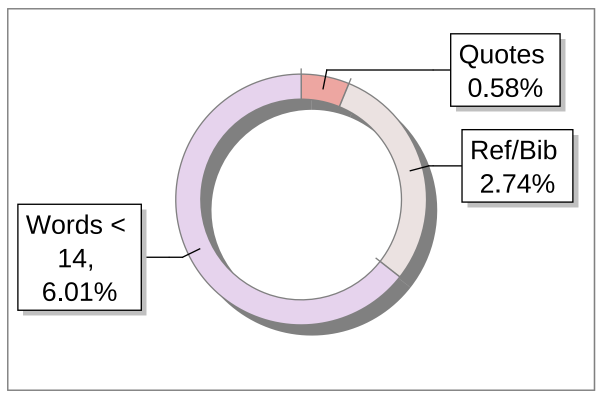

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CHAPTER 1

INTRODUCTION

1.1General:

In an era marked by rapid urbanization, escalating energy demands, and pressing environmental concerns, the built environment stands as both a pivotal battleground and a beacon of hope. Buildings, whether towering skyscrapers or humble residential dwellings, are not only the backdrop of our daily lives but also significant contributors to global energy consumption and carbon emissions. As the world grapples with the imperative to mitigate climate change and transition towards sustainable practices, the role of buildings in this endeavor cannot be overstated.

Against this backdrop, the concept of "compassion of energy stimulation in conventional and green building" emerges as a timely and critical exploration. This project embarks on a multifaceted journey, delving deep into the intricacies of energy consumption, efficiency, and sustainability within the built environment. Through the lens of advanced software tools such as Revit 2022 FOR modeling and Insight 2022 FOR energy simulation, this endeavor seeks not only to unravel the complexities of building energy performance but also to inspire transformative change in architectural and engineering practices.

At its core, the project is propelled by a profound sense of compassion—a recognition of the interconnectedness between human activity, the built environment, and the natural world. It is born out of a deep-seated desire to alleviate the burdens imposed by unsustainable practices on both present and future generations. By fostering a holistic understanding of energy dynamics in buildings, from conventional structures to their green counterparts, the project endeavors to cultivate empathy towards the planet and its inhabitants.

1.2 GREEN BUILDING:

In the quest FOR a sustainable future, the built environment stands as both a challenge and an opportunity. As populations swell and urban landscapes evolve, the demand FOR buildings that not only meet our needs but also tread lightly on the planet has never been more urgent. At the Forefront of this movement towards sustainability stands the concept of green building—a paradigm shift that transcends mere construction to embrace principles of environmental responsibility, resource efficiency, and human well-being.

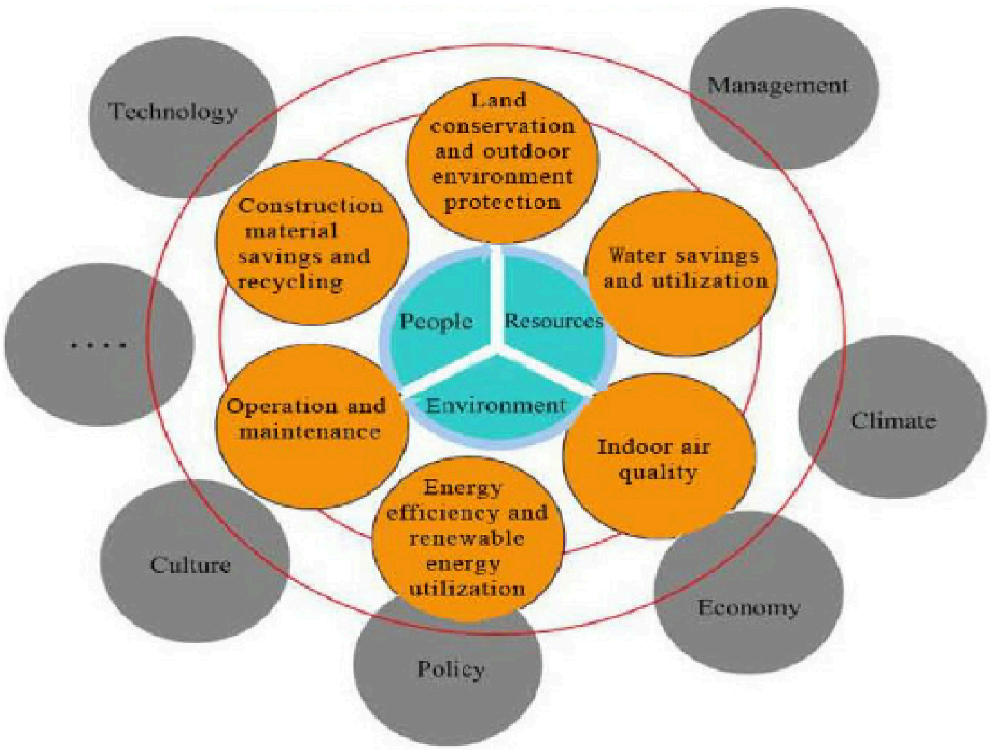


Figure: 1.1 Concept of green building

Green buildings, often hailed as the cornerstone of sustainable development, embody a holistic approach to design, construction, and operation. They eschew the traditional notion of buildings as passive structures, instead embracing an ethos of integration, innovation, and harmony with the natural world. From their inception, green buildings are conceived with a profound respect FOR the environment, seeking to minimize their ecological footprint while maximizing their positive impact on occupants and communities.

Central to the ethos of green building is the imperative to address energy consumption—a critical determinant of both environmental sustainability and economic viability. Historically, buildings have been voracious consumers of energy, guzzling electricity FOR lighting, heating, cooling, and a myriad of other functions. This profligate energy usage not only strains finite resources but also exacerbates environmental degradation, contributing to greenhouse gas emissions, air pollution, and climate change.

In this context, the nexus between green building and energy consumption emerges as a focal point of inquiry, innovation, and intervention. Green buildings, distinguished by their emphasis on energy efficiency, renewable energy integration, and passive design strategies, offer a compelling alternative to their conventional counterparts. Through a combination of cutting-edge technologies, thoughtful design principles, and operational best practices, green buildings strive to minimize energy demand while maximizing performance , resilience, and occupant comfort.

Yet, the transition towards green building and low-energy design is not without its challenges. It requires a paradigm shift in the way buildings are conceive`d, financed, constructed, and operated—a departure from business-as-usual practices towards a more holistic, systems-oriented approach.

1.3Scope of comparative study on conventional and green building

The scope of a comparative study between conventional and green buildings is broad and multifaceted, encompassing various dimensions of architectural, environmental, social, and economic considerations. Below are some key aspects within the scope of such a study:

1.3.1Energy Performance: A central focus of the study would be to compare the energy consumption and efficiency of conventional buildings with their green counterparts. This would involve analyzing factors such as heating, cooling, lighting, and appliance usage to determine the overall energy demand and performance of each building type.

1.3.2Environmental Impact: Assessing the environmental footprint of conventional and green buildings is crucial. This includes evaluating factors such as greenhouse gas emissions, resource depletion, waste generation, and water consumption throughout the lifecycle of each building type, from construction to operation and eventual demolition.

1.3.3Resource Efficiency: Examining the use of natural resources, such as water and materials, is essential in comparing conventional and green buildings. This involves assessing the efficiency of resource utilization, the incorporation of sustainable materials, and the implementation of water-saving technologies in both building types.

1.3.4 Indoor Environmental Quality (IEQ): Comparing the indoor environmental quality between conventional and green buildings is vital FOR such as air quality, thermal comfort, day lighting, and acoustics would be evaluated to determine the overall IEQ of each building type.

1.3.5Life Cycle Cost Analysis (LCCA): Conducting a life cycle cost analysis helps in comparing the economic viability of conventional and green buildings over their entire lifespan. This involves evaluating initial construction costs, operational expenses, maintenance costs, and potential savings from energy efficiency measures and other sustainable features.

CHAPTER 2

2.1 work break down structure(WBS):

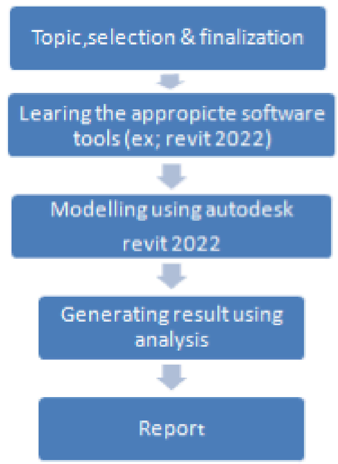


Figure: 2.1 Work Breakdown Structure.

2.1.1 Timeline Development-Schedule:

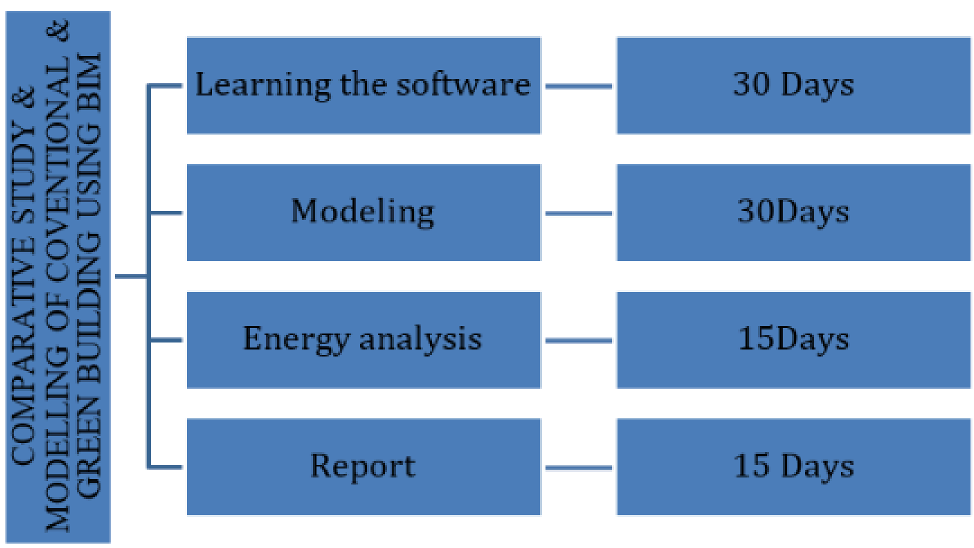


Fig No. 2.1.2: Timeline Development Schedule.

2.1.2 Cost Breakdown Structure (CBS)

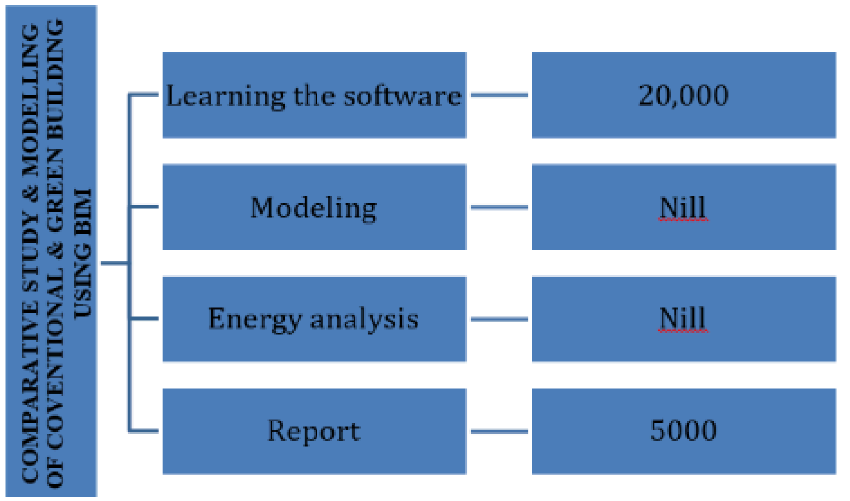


Fig No. 2.1.3: Cost Breakdown Structure.

2.2 Capstone Project Risk Assessment

2.2.1 Data Quality and Availability

Risk: Insufficient or inaccurate data may lead to flawed energy analysis.

Mitigation: Prioritize data validation and verification processes. Collaborate with reliable sources FOR accurate building data. Develop contingency plans FOR missing or incomplete data.

2.2.2 Technical Complexity

Risk: Complex modeling techniques or software limitations may hinder accurate energy analysis.

Mitigation: Conduct thorough training on BIM software tools and energy analysis methodologies. Seek assistance from experienced mentors or industry professionals. Break down complex tasks into manageable steps.

2.2.3 Interdisciplinary Collaboration

Risk: Challenges in coordinating between different disciplines (e.g., architecture, engineering) may delay progress

2.2.4 Regulatory Compliance

Risk: Failure to comply with local building codes or energy regulations could invalidate the project results.

Mitigation: Stay updated on relevant regulations and standards. Consult with regulatory authorities or experts to ensure compliance. Allocate sufficient time and resources FOR regulatory research and compliance checks.

2.2.5 Scope Creep

Risk: Expanding project scope beyond the initial plan may strain resources and timelines.

Mitigation: Define clear project objectives and scope boundaries. Regularly review and prioritize project tasks to prevent scope creep. Document any scope changes and assess their impact on project goals and timelines.

2.3 Requirement Specification

2.3.1 Functional

Functional Requirement Specifications (FRS) typically outline the specific functionalities andfeatures that a software application should possess.

2.3.2 Model Creation and Editing

Users should be able to create and edit architectural, structural, and MEP models within Revit 2022.

Include requirements FOR creating walls, floors, roofs, columns, beams, ducts, pipes, etc.

2.3.3 Collaboration and Coordination

Enable real-time collaboration among team members working on the same project.

Include requirements FOR version control, work-sharing, and model coordination features.

2.4 Analysis and Simulation

Provide tools FOR energy analysis, delighting analysis, and structural analysis within the Revit environment.

Specify requirements FOR running analysis simulations and interpreting results.

2.4.1 Documentation and Reporting

Facilitate the generation of construction documents, schedules, and reports directly from the Revit model.

Specify requirements FOR creating sheets, annotations, schedules, and custom reports.

2.4.2 BIM Data Exchange

Support interoperability with other BIM software and file Formats (e.g., IFC, DWG, DGN).

Specify requirements FOR importing/exporting models and maintaining data integrity.

2.5 Some Features Of Revit 2022

2.5.1 Generative Design: Revit 2022 introduces generative design capabilities, allowing users to explore and optimize design alternatives based on specific goals and constraints. This feature leverages computational design algorithms to generate and evaluate multiple design options, helping architects and engineers make informed decisions early in the design process.

2.5.2 Dynamo Player: Building upon its integration with Dynamo, Revit 2022 introduces the Dynamo Player, a user-friendly interface FOR running Dynamo scripts directly within the Revit environment. This feature enables non-programmers to automate repetitive tasks, create custom design workflows, and enhance productivity without extensive coding knowledge.

2.5.3 Improved Collaboration: Revit 2022 enhances collaboration among project teams with improved interoperability and coordination features. Users can now more seamlessly exchange BIM data with external stakeholders, leveraging industry-standard file Formats such as IFC and DWG. Additionally, enhancements to the Revit Cloud Work-sharing platform facilitate real-time collaboration and version control in multi-disciplinary project environments.

2.5.4 Enhanced Documentation: Revit 2022 introduces enhancements to management capabilities, and streamlined workflows FOR creating and managing sheets and views. These enhancements help architects and engineers produce high-quality drawings and specifications with greater ease and accuracy.

2.6 Non-Functional (Quality attribute)

REVIT 2022

2.6.1performance: Revit 2022 should provide responsive performance , even with large and complex models Specify requirements FOR minimum hardware specifications and performance benchmarks.

Load Time: Revit 2022 should minimize the time required to load project files and initialize the software, enabling users to start working without undue delay.

2.6.2User Interface and Usability

The user interface should be intuitive and user-friendly, with customizable settings and preferences.

Specify requirements FOR navigation, toolbars, menus, and contextual help features.

2.6.3 Security and Data Integrity

Ensure data security and integrity by implementing user authentication, access controls, and data encryption.

Specify requirements FOR backup and recovery procedures to prevent data loss.

2.6.4Compatibility and Integration

Revit 2022 should be compatible with other software tools commonly used in the AEC industry.

Specify requirements FOR interoperability with Autodesk products and third-party applications.

2.6.5Constraints and Assumptions

List any constraints or assumptions that may impact the implementation of functional requirements.

Include constraints related to budget, timeline, resource availability, etc.

2.7 User Input

In Revit 2022, user input plays a crucial role in creating, modifying, and interacting with building models and project data. Here's how users provide input in Revit 2022:

2.7.1 Modeling Tools: Users can create and modify building elements such as walls, floors, roofs, doors, windows, and structural components using a variety of modeling tools available in Revit. They provide input by selecting tools from the ribbon interface and specifying parameters such as dimensions, materials, and placement options.

2.7.2 Properties Palette: Users can access the Properties palette to view and modify properties of selected elements in the model. By selecting an element and navigating to its properties, users can input data such as dimensions, constraints, materials, and other attributes that define the element's properties and behavior.

2.7.3 Dialog Boxes: Revit 2022 presents various dialog boxes and user interfaces FOR performing specific tasks and workflows. Users input data and make selections within these dialog boxes to configure settings, initiate commands, and define parameters FOR actions such as creating views, generating schedules, and running analysis simulations.

2.7.4 Keyboard Shortcuts: Users can input commands and navigate the software interface using keyboard shortcuts, providing an efficient way to execute common tasks and access frequently used tools and features without relying solely on the mouse or touch interface.

2.7.5 Contextual Menus: Revit 2022 offers contextual menus that provide quick access to relevant commands and options based on the current selection or context within the software interface. Users can right-click on elements, views, or areas of the interface to access context-sensitive menus and input commands directly.

2.8 Design/Drafting Specification

2.8.1 Chosen System Design/Drafting

2.8.1.1 Revit 2022

Revit 2022, the latest iteration of Autodesk's renowned building information modeling (BIM) software, continues to empower architects, engineers, and construction professionals with innovative tools and features FOR designing, modeling, and documenting building projects. Building upon its legacy of parametric modeling and collaborative workflows, Revit 2022 introduces enhancements aimed at improving productivity, performance, and interoperability. With new features such as generative design capabilities, users can explore and optimize design alternatives to achieve their project goals efficiently.

The integration of the Dynamo Player streamlines automation workflows, enabling users to automate repetitive tasks and customize design processes with ease. Enhanced interoperability with industry-standard file Formats and cloud collaboration tools fosters seamless collaboration among project stakeholders, regardless of accessibility enhancements promote inclusivity and usability FOR users with diverse needs. Revit 2022 reaffirms its position as a cornerstone tool in the AEC industry, empowering professionals to realize their design visions and deliver high-quality.

Benefits Of Revit 2022

2.8.1.2 Integrated BIM Environment: Revit provides an integrated platform FOR building information modeling (BIM), allowing users to create, manage, and analyze building models and project data in a single environment. This integrated approach facilitates coordination and consistency across design disciplines, reducing errors and improving project efficiency.

2.8.1.3 Parametric Modeling: Revit's parametric modeling capabilities enable users to create intelligent 3D models that capture design intent and respond dynamically to changes. By defining parameters and relationships between elements, users can explore design alternatives, evaluate options, and adapt to evolving project requirements with ease.

2.8.1.4 Collaborative Workflows: Revit supports collaborative workflows through features such as Work-sharing and cloud collaboration tools. Multiple team members can work on the same project simultaneously, coordinating their efforts and sharing project data in real-time. This fosters seamless collaboration among project stakeholders, regardless of their location or role.

2.8.1.5 Efficient Documentation: Revit automates the generation of construction documentation, including floor plans, elevations, sections, schedules, and material take-offs. Changes made to the building model are reflected automatically in the documentation, ensuring accuracy and consistency throughout the design process.

2.9 Discussion of Alternative Design: Discussing alternative designs in parametric modeling involves exploring different design configurations by adjusting parameters and evaluating their impact on various design criteria. Here's how alternative design discussions can be conducted within the context of parametric modeling:

2.9.1 Parameter Exploration: Parametric modeling allows designers to define parameters such as dimensions, materials, and performance criteria that drive observing the resulting changes in the model. FOR example, in architectural design, parameters such as building height, floor area, window size, and orientation can be varied to explore different spatial configurations and building layouts.

2.9.2 Design Optimization: Parametric modeling enables designers to optimize designs based on specific goals and constraints. By defining performance criteria such as energy efficiency, structural stability, delighting, and occupant comfort, stakeholders can iteratively refine design parameters to achieve desired outcomes. Alternative design options can be evaluated based on their performance metrics, allowing stakeholders to identify the most effective solutions FOR further development.

2.9.3 Iterative Refinement: Parametric modeling facilitates an iterative design process where alternative design options are continuously refined and improved based on feedback and analysis. Designers can create multiple iterations of a design, each representing a different configuration or variation, and compare their performance against predefined criteria. Through iterative refinement, stakeholders can converge on optimal design solutions that balance competing priorities and constraints.

2.9.4 Visualization and Analysis: Parametric modeling software provides visualization and analysis tools to help stakeholders assess alternative design options. Visual representations such as 3D models, renderings, and animations allow stakeholders to visualize proposed designs and understand their spatial qualities. Analysis tools enable stakeholders to evaluate the performance of alternative designs in terms of energy consumption, structural integrity, delighting, thermal comfort, and other criteria, helping them make informed decisions.

2.9.5 Collaborative Decision-Making: Parametric modeling supports collaborative decision-making by enabling multiple stakeholders to participate in design discussions. Design options can be shared and reviewed in real-time, allowing stakeholders to provide feedback, suggest modifications, and contribute their expertise. Collaborative workflows foster interdisciplinary collaboration.

2.9.6 Detailed Description of Components/Subsystems

In Revit 2022, the software is organized into several components and subsystems that work together to facilitate the creation, management, and analysis of building information models (BIM). Here's a detailed description of some of the key components and subsystems in Revit 2022:

2.9.6.1 User Interface (UI): The User Interface (UI) provides the visual and interactive elements that users interact with to create and modify building models. It includes ribbon menus, toolbars, property palettes, and navigation controls FOR accessing commands, tools, and project data.

2.9.6.2 Parametric Modeling Engine: At the core of Revit is its parametric modeling engine, which enables users to create intelligent 3D models of buildings and building components. The modeling engine allows users to define parameters and relationships between elements, enabling designs to be dynamically adjusted and updated based on changes to input parameters.

2.9.6.3 Element Library: Revit includes a comprehensive library of building elements and components, such as walls, floors, roofs, doors, windows, structural elements, and MEP (Mechanical, Electrical, and Plumbing) fixtures. These pre-built elements can be easily inserted into building models and customized to meet project requirements.

2.9.6.4 Family Editor: The Family Editor is a subsystem within Revit that allows users to create custom parametric families FOR building components that are not available in the standard element library. Users can define geometric shapes, parameters, constraints, and behavior FOR custom families, enabling the creation of unique building components tailored to specific project needs.

2.9.6.5 View Management: Rivet's view management subsystem allows users to create, organize, and control different views of the building model, including floor plans, elevations, sections, and 3D views. Users can customize view settings, apply visibility and graphic overrides, and control the display of model elements to optimize visualization and documentation.

2.10 Components:

In Revit, the term "component 1-n" is not a specific designation within the software. However, if we interpret "component 1-n" as a generic reference to various types of components or elements that can be found in Revit models, we can discuss it in a broader context.

2.10.1 Architectural Components:

Walls. Floors, Roofs, Doors, Windows, Stairs, Ceilings

2.10.2 Structural Components:

Columns, Beams, Braces, Foundations, Slabs, Structural connections

2.10.3 MEP Components:

HVAC equipment (e.g., air handling units, fans, ductwork)

Plumbing fixtures (e.g., sinks, toilets, pipes)

Electrical components (e.g., lighting fixtures, receptacles, conduits)

N 2.3.3.4 Specialty Components:

Furniture, Fixtures (e.g., sinks, bathtubs)

Equipment (e.g., appliances, machinery)

Landscape elements (e.g., trees, plants, site features)

2.10.4 Site Components:

Topography: Terrain surfaces, contour lines, and site grading elements.

Site Features: Roads, sidewalks, parking lots, fences, retaining walls, and landscape elements.

Site Utilities: Utility lines (e.g., water, sewer, gas, electrical), manholes, catch basins, and storm water management facilities.

2.10.5 Annotation Components: Text: Annotations such as labels, dimensions, and callouts to provide additional information about the model.

Symbols: Graphic symbols representing elements such as doors, windows, fixtures, and equipment.

Detail Components: Detail lines, detail components, and drafting elements used to annotate and document the model with detail drawings.

CHAPTER 3

APPROACH AND METHODOLOGY

3.1Methodology:

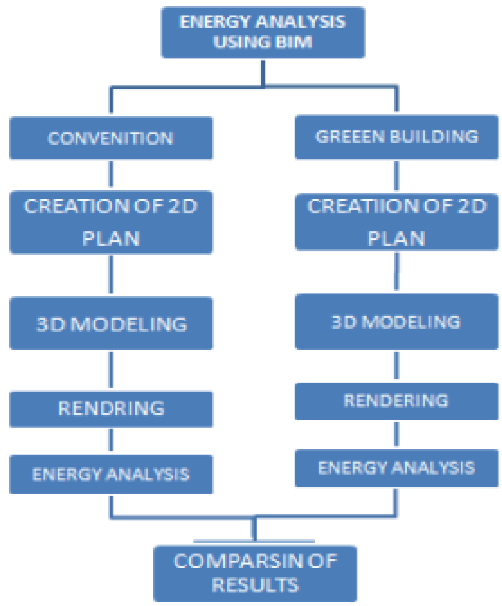


Figure: 3.1Methodology

When embarking on a project within Revit 2022, a structured approach and methodology are crucial FOR ensuring efficiency, accuracy, and collaboration throughout the design process. This begins with a thorough understanding of the project requirements, encompassing its scope, objectives, and constraints. Gathering and organizing project data, including site surveys and architectural drawings, lays the groundwork FORinformed decision-making. Establishing clear project standards, such as naming conventions and modeling guidelines, promotes consistency and facilitates seamless collaboration among team members. the project structure and setting .

3.1.1 procedure FORRevit 2022 software

Fig: Procedure FOR Revit 2022 software

3.2 TECHNOLOGY

3.2.1 Parametric Modeling: Revit's parametric modeling capabilities allow designers to create and manipulate 2D elements such as walls, doors, windows, and other architectural components with precision. These elements are inherently intelligent, meaning changes made to one part of the model automatically update throughout the project.

3.2.2 Revit Families: Families are reusable, customizable content items in Revit. They include 2D symbols and 3D models representing real-world building components. By utilizing pre-made or custom families, designers can efficiently populate their 2D plans with accurate representations of doors, windows, furniture, fixtures, and other objects.

3.2.3Detail Components: Revit provides a library of detail components, such as symbols FOR annotations, dimensions, text, and graphic elements. Designers can add these components to 2D views to enhance clarity and communication in their plans.

3.2.4View Templates: View templates allow designers to control the display settings FOR different types of views, including floor plans, elevations, sections, and detail views. By applying view templates, designers can ensure consistency in the appearance of their 2D plans throughout the project.

3.2.5 Annotation Tools: Revit offers a variety of annotation tools FOR adding text, dimensions, tags, and symbols to 2D views. These tools help communicate important information about the design intent, dimensions, and specifications within the plans.

3.3 METHODOLOGIES

3.3.1 Research Methods: Many capstone projects involve conducting research to investigate a specific topic or problem. Research methodologies may include qualitative methods such as interviews, focus groups, or case studies, as well as quantitative methods such as surveys, experiments, or statistical analysis.

3.3.2 Literature Review: Before embarking on their own research, students often conduct a comprehensive review of existing literature relevant to their topic. This helps to establish the context for their work, identify gaps in the current knowledge base, and build upon previous research.

3.3.3 Data Collection and Analysis: Depending on the nature of the project, students may collect and analyze data to answer research questions or test hypotheses. This could involve gathering primary data through surveys, experiments, or observations, or analyzing secondary data from existing sources such as databases or published studies.

3.3.4 Design and Implementation: For projects in fields like engineering, computer science, or design, students may focus on designing and implementing a solution to a real-world problem. This could involve developing prototypes, writing code, or creating architectural plans, followed by testing and iteration.

3.3.5 Project Management: Capstone projects often require effective project management skills to plan and execute tasks within a given timeframe. Students may use project management methodologies such as Agile or Waterfall to organize their work, set milestones, and track progress.

3.4 PROGRAMMING

3.4.1 Python: Data Analysis: Python's libraries such as NumPy, Pandas, and Matplotlib are used for analyzing large datasets collected from surveys, sensors, or simulations.

Computational Modeling: Packages like Sic provide tools for solving differential equations, optimization problems, and numerical integration, which are essential for modeling various engineering phenomena.

3.4.2 MATLAB: Numerical Simulations: MATLAB's extensive library of built-in functions and toolboxes is well-suited for conducting simulations of structural, hydraulic, or geotechnical systems.

Signal Processing: MATLAB is used for analyzing signals from sensors or monitoring systems, such as analyzing vibration data from bridges or buildings.

3.4.3 R: Statistical Analysis: R is utilized for performing advanced statistical analyses on datasets related to materials testing, environmental monitoring, or transportation studies.

3.4.4 VBA: Automation in Excel: VBA macros are commonly used to automate repetitive tasks in Excel, such as generating reports, performing calculations, or formatting data.

3.4.5 Java or C++: Custom Software Development: For projects requiring the development of specialized software tools or simulations, Java or C++ may be used to create efficient and robust applications.

3.5 MODELING

3.5.1 Structural Analysis: Modeling software like SAP2000, ETABS, or Staad.Pro are commonly used for structural analysis of buildings, bridges, or other infrastructure. Students might create detailed models of structures to simulate real-world conditions and analyze factors like stress distribution, load-bearing capacity, and structural integrity.

3.5.2 Finite Element Analysis (FEA): FEA software such as Abaq us or ANSYS is employed to analyze complex structural behaviors under different loading conditions. Students can create finite element models to simulate the response of structures to various forces and environmental factors.

3.5.3 Geotechnical Modeling: In projects related to soil mechanics and foundation engineering, geotechnical modeling software like PLAXIS or FLAC might be utilized. Students can create models to analyze soil-structure interaction, slope stability, and foundation design.

3.5.4 Hydraulic Modeling: For projects involving water resources or hydraulic engineering, modeling software such as HEC-RAS or MIKE is commonly used. Students can develop hydraulic models to analyze river flow, flood behavior, sediment transport, and water distribution systems.

3.5.5Transportation modeling: Civil engineering capstone projects focusing on transportation engineering often involve modeling traffic flow and transportation networks. Software like VISSIM or Transcend can be used to simulate traffic patterns, optimize transportation systems, and evaluate the impact of infrastructure changes.

CHAPTER 4

TEST AND VALIDATION

4.1 Test Plan

Creating 2D Drawing in Revit

Creating a 2D model of a building in Revit involves several steps. Here's a simplified guide:

1. Set Up the Project: Open Revit and start a new project. Set up project units, location, and levels as per your building requirements.

2. Draw Walls: Use the wall tool to draw the perimeter of your building. You can specify wall types and dimensions as needed.

3. Add Doors and Windows: Use the door and window tools to add openings to your walls. Place them accurately according to your building plan.

4. Create Floors: Use the floor tool to create floor slabs on each level of your building. You can adjust the thickness and material of the floors.

5. Add Annotations: Add text, dimensions, and other annotations to your 2D views to provide additional information about the building.

6. Create Sections and Elevations: Generate section and elevation views to show different aspects of the building in 2D. Use the section and elevation tools to create these views.

7. Detailing: Add additional details to your 2D views as necessary, such as structural elements, furniture layouts, and landscaping features.

8. Check for Errors: Use Revit's tools to check for errors in your model, such as overlapping elements or incorrect dimensions.

9. Documentation: Generate construction documentation from your 2D views, including plans, sections, elevations, and schedules.

4.1.1 Set Up the Project:

Create the Floor Plan View, Draw Walls, Add Doors and Windows, Create Interior Walls, Add Annotations, Create Levels and Sections, Detailing, Check for Errors, Documentation

4.1.2 DRAWING WALLS:

Access the Wall Tool, Select Wall Type, Choose Placement Method ,Single Line ,Rectangle, Polygon, Pick Walls ,,Draw Walls, Adjust Properties, Snap and Alignment, Modify Walls, Finish and Confirm

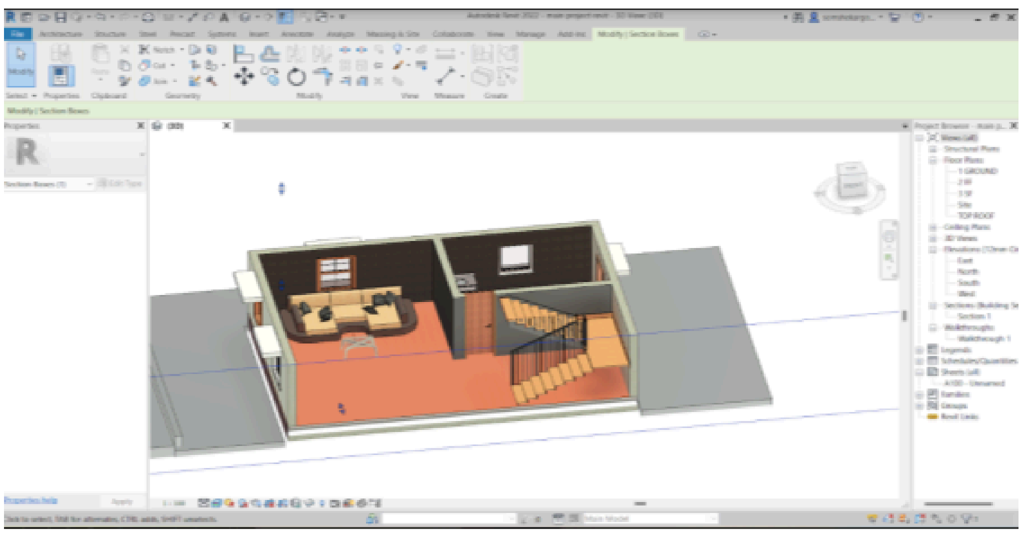
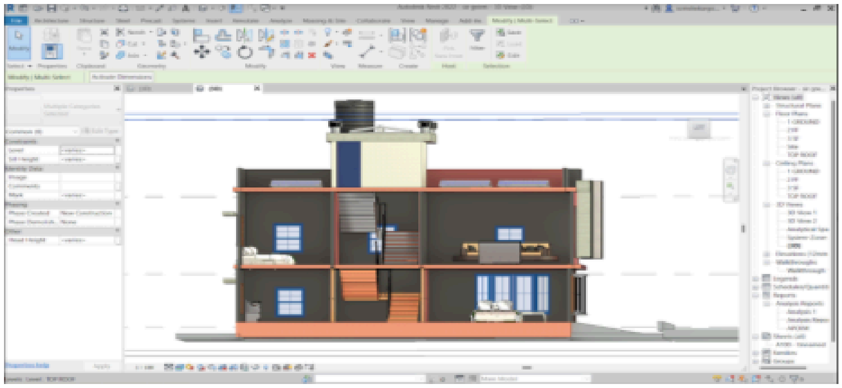


Figure:4.1

4.1.3Doors and Windows:

Access the Door/Window Tool, Select Door or Window, Place the Opening, Adjust Placement, Set Parameters, Duplicate Openings, Load Families, Review in 3D View.



4.1.4Creating Floor

Open Revit ,Start a Project, Select the Level, Navigate to the Floor Tool, Choose Floor Command, Select Floor Type, Sketch the Floor Boundary, Adjust and Modify, Finish Editing, Review in 3D, Save the project

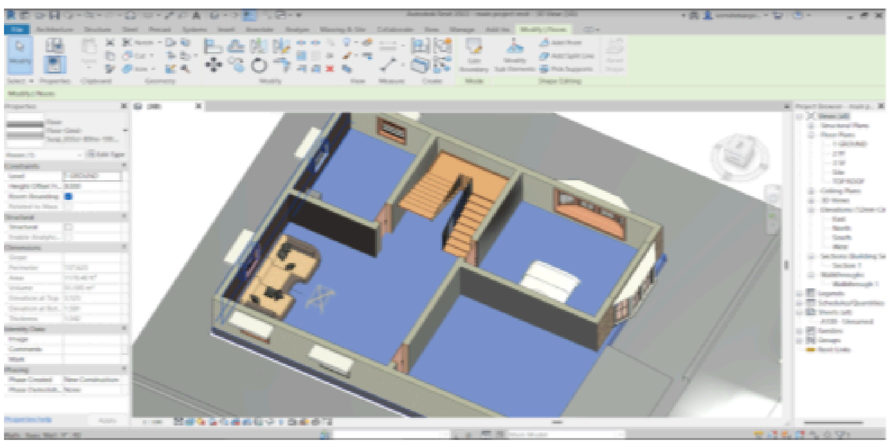


Figure: 4.2

4.1.5Adding Annotations into the project :

Open Revit, Open or Start a Project, Navigate to the Annotation Tab, Select Annotation Type, Add Text Annotation, Add Dimensions, Add Detail Lines, Add Symbols, Modify Annotations, Review Annotations, Save your Project.

4.2Creating 3D Drawing in Revit

1. Open Revit: Launch Revit software on your computer.

2. Start a New Project: Begin by starting a new project or opening an existing one where you want to create the 3D drawing of the building.

3. Set Up Levels and Grids: Define the levels and grids of the building. Levels represent the different floor heights, and grids provide reference lines to aid in modeling. Go to the "Architecture" tab and click on "Level" to create new levels. Use the "Grid" tool to create grid lines as needed.

4. Create Building Elements: Use the various modeling tools in Revit to create building elements such as walls, floors, roofs, and structural components.

- Walls: Click on the "Wall" tool in the "Architecture" tab and draw walls by specifying their start and end points.
- Floors: Use the "Floor" tool to create floor slabs on each level of the building. Sketch the boundary of the floor slab using the sketch tools.
- Roofs: Create roofs using the "Roof" tool. Choose the roof type and sketch its footprint on the top level of the building.

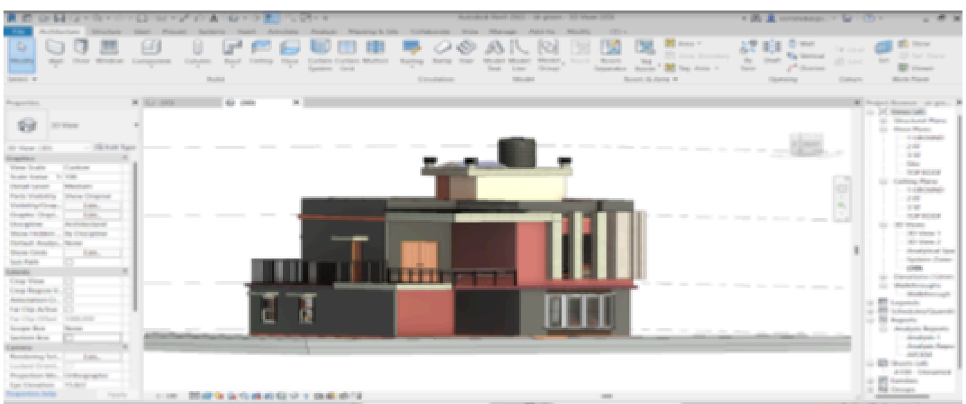


Figure: 4.3 GREEN BUILDING

5. Add Doors and Windows: Use the "Door" and "Window" tools to add openings in the walls for doors and windows. Specify the type and size of each opening.

6. Detail the Building: Add detail elements such as stairs, railings, and architectural features to enhance the realism of the model.

7. Apply Materials: Assign materials to the building elements to give them realistic appearances. Go to the "Manage" tab and click on "Materials" to access the material library and apply materials to the model.

8. Furnish the Interior: Add furniture, fixtures, and other interior elements to complete the interior design of the building.

9. Review in 3D View: Switch to a 3D view to review the building model from different angles and perspectives. Use the navigation tools to explore the model in 3D

10. Adjust and Refine: Fine-tune the building elements, adjust their dimensions, and make any necessary modifications to ensure accuracy and completeness.

11. Save Your Project: Save your Revit project to retain the 3D drawing of the building for future reference and collaboration.

4.2.1Set Up Levels and Grids

1. Open Revit.

2. Start or open a project.

3. Go to the "Architecture" tab.

4. Click on "Level".

5. Create new levels by specifying points.

6. Go to the "Architecture" tab.

7. Click on "Grid”. Create grid lines by specifying points.

4.2.2 Create Building Elements

Here’s a concise step-by-step guide to creating building elements in a Revit project:

Open Revit, Start or open a project ,Set up levels and grids, Create walls, Add doors and windows, Create floors, Design roofs., Model structural components, Detail the building, Apply materials, Furnish the interior, Review in 3D view, Adjust and refine., Save your project.

4.2.3Detail the Building

1. Open Revit.

2. Start a new project or open an existing one.

3. Define levels and grids.

4. Create building elements (walls, floors, roofs, structural components).

5. Add doors and windows.

6. Detail the building (stairs, railings, architectural features).

7. Apply materials.

8. Furnish the interior.

9. Review in 3D view.

10. Adjust and refine.

11. Save the project.

4.2.4 Apply Materials

1. Open the project in Revit.

2. Go to the "Manage" tab.

3. Click on "Materials" to access the material library.

4. Select the element you want to apply the material to.

5. In the property's palette, under "Material", click on "Browse" or "Edit" to select the desired material.

6. Click "OK" to apply the material to the selected element.

4.2.5 Furnish the Interior

1. Open Revit.

2. Load furniture families.

3. Place furniture elements in the project.

4. Adjust the placement and orientation of furniture.

5. Add additional interior elements such as fixtures and decor.

6. Modify and adjust as needed.

7. Review in 3D view.

8. Save the project.

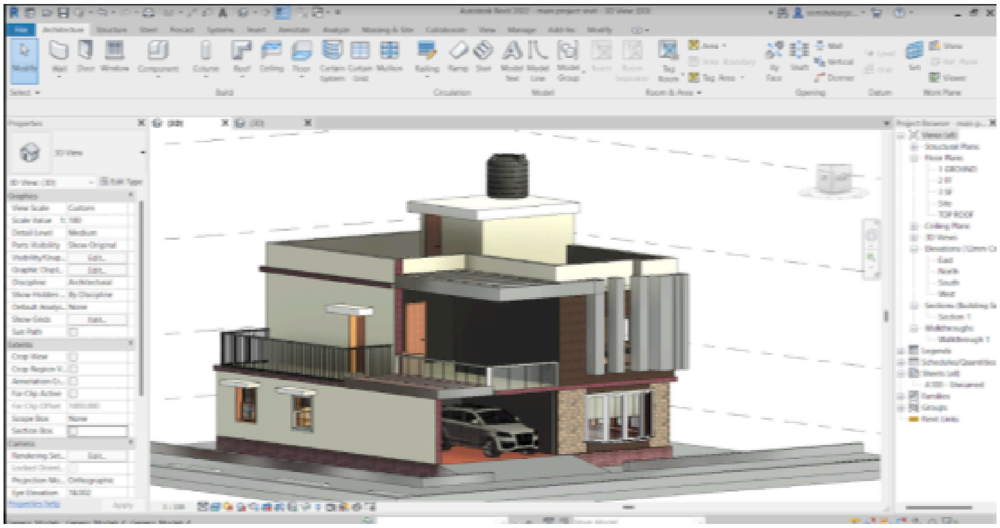


Figure:4.4 NORMAL BUILDING

4.2.6 Review in 3D View

1. Open Revit.

2. Load your project.

3. Navigate to the "View" tab.

4. Click on "3D View" in the "Create" panel.

5. Choose the desired 3D view type (e.g., Default 3D View, Camera, or Section Box).

6. Adjust the view orientation and settings as needed.

7. Explore the 3D model using navigation tools like Orbit, Pan, and Zoom.

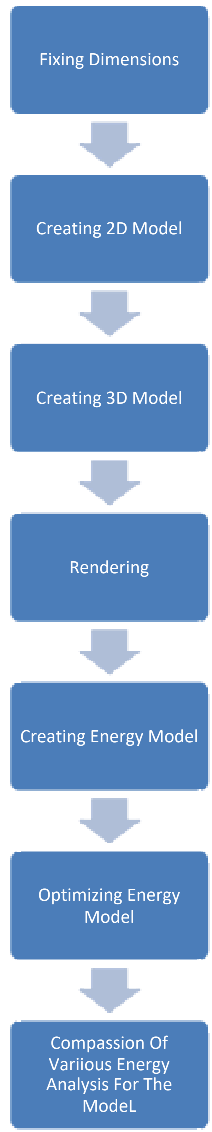
8. Analyze the building design and elements from different angles.

9. Check for any inconsistencies or errors in the model.

10. Make any necessary adjustments or annotations.

11. Save your project.

4.3 TEST APPROCH



COMPARATIVE STUDY AND MODELING OF CONVENTIONAL ANND GREEN BUILDING USING BIM DEPT. OF CIVIL ENGINEERING, ADICHUNCHANAGIRI POLYTECHNIC, CHIKKAMAGLURU Page 32 4.4 FEATURES TESTED 4.4.1 Result • Benchmark compression Benchmarking in Revit typically involves comparing the performance of your Revit model across different hardware setups or software configurations to determine which setup is more efficient or to identify areas for improvement. Here's how you can conduct a benchmark comparison in Revit: 1. Define Benchmark Criteria: Determine what aspects of Revit performance you want to measure. This could include model load time, navigation speed, rendering time, or overall responsiveness. 2. Create Test Models: Develop a standardized test model that represents typical projects you work on. Ensure the model includes a range of elements such as walls, doors, windows, furniture, MEP components, etc., to simulate real-world scenarios.

COMPARATIVE STUDY AND MODELING OF CONVENTIONAL ANND GREEN BUILDING USING BIM DEPT. OF CIVIL ENGINEERING, ADICHUNCHANAGIRI POLYTECHNIC, CHIKKAMAGLURU Page 33 3. Set Up Test Environments: Install Revit on the different hardware setups or software configurations you want to compare. Ensure that the versions of Revit and any relevant plugging or add-ons are consistent across all setups. 4. Run Tests: Load the test model into each Revit environment and perform the tasks outlined in your benchmark criteria. Time how long it takes to perform each task and note any performance issues or delays. 5. Record Results: Document the performance metrics for each test run, including load times, task completion times, and any observations about performance issues or bottlenecks. • Model Result 1. Generative Design: Revit 2022 introduced Generative Design capabilities, allowing users to explore design options and generate various solutions based on specific goals and constraints. This feature empowers designers to create more optimized and innovative designs.

2. Real-Time Realistic Views: With the introduction of Real-Time Realistic Views, users could experience their designs in a more immersive and realistic way directly within the Revit environment. This feature helps in better visualization and communication of design intent.

3. Enhanced Modeling Tools: Revit 2022 included enhancements to existing modeling tools, such as improved control over geometry and parameters. These enhancements aimed to make modeling tasks more intuitive and efficient for users.

4. Parametric Components: The Parametric Components feature allowed users to create and manipulate intelligent building components with parametric relationships. This feature facilitates the creation of complex, customizable elements within Revit projects.

5. Performance Improvements: Revit 2022 focused on improving software performance, particularly for large and complex projects. This included optimizations for faster loading times, smoother navigation, and better overall responsiveness.

- **Construction of Wall**

1. Select Wall Type: Start by selecting a wall type from the available library or by creating a new one. Wall types in Revit define the basic properties of a wall, such as thickness and structure.

2. Edit Wall Type: Once you've selected a wall type, you can edit its properties to define the construction layers. Each layer represents a different material or component of the wall assembly.

3. Add Layers: Within the wall type editor, you can add new layers to the wall construction. For each layer, specify properties such as material, thickness, function, and any other relevant parameters.

4. Define Material Properties: Revit includes a library of predefined materials, but you can also create custom materials with specific properties if needed. Assign appropriate materials to each layer of the wall construction.

5. Adjust Layer Order: Arrange the layers in the desired order to reflect the actual construction sequence. Revit allows you to easily reorder layers by dragging and dropping them within the wall type editor.

6. Set Parameters: Configure additional parameters for the wall type, such as thermal properties, structural properties, fire ratings, and more, depending on the requirements of your project.

- **Roof construction**

1. Create a Roof: Start by selecting the "Roof" tool from the "Build" panel on the "Architecture" tab. Choose the type of roof you want to create, such as a sloped roof, flat roof, or a specific roof by footprint.

2. Sketch the Roof: After selecting the roof type, you'll need to sketch the footprint of the roof on the floor plan view. Click to place points to define the outline of the roof, and use the available tools to adjust slopes, angles, and other parameters as needed.

3. Edit Roof Properties: Once you've sketched the roof footprint, you can adjust various properties of the roof, such as slope, overhangs, and materials. This can be done in the properties palette or by selecting the roof .

4. Add Roof Slopes: For sloped roofs, you can further refine the slopes by adjusting individual roof segments or defining slope values for the entire roof. Revit provides tools to easily control the slope angle and direction of each segment.

5. Modify Roof Structure: Revit allows you to specify the construction details of the roof, including layers, materials, and structural components. You can edit the roof assembly to add insulation, sheathing, structural framing, and other elements as needed.

6. Add Roof Openings: If your roof design includes openings for skylights, vents, or other features, you can use the "Opening" tool to cut openings directly into the roof geometry. These openings can be customized in size, shape, and location to accommodate various building elements.

7. Review and Modify: Once the roof is created, review it in 3D view to ensure it matches your design intent. You can make further adjustments to the roof geometry, slopes, or materials as needed to achieve the desired result.

8. Document and Annotate: Finally, document the roof construction by adding annotations, dimensions, and other details to your drawings. This helps communicate the roof design and construction requirements to other project stakeholders.

4.4 Feature Not Tested

1. Complexity: Some features introduce considerable complexity to the software, making it challenging to test all possible scenarios comprehensively. This complexity can arise from interactions with existing features, integration with other software components, or variations in user workflows.

2. Time Constraints: Software development timelines may not always allow for thorough testing of every feature before release. Developers may prioritize certain features or focus on fixing critical bugs, leaving less time for comprehensive testing of new functionalities.

3. Limited Resources: Testing resources, including time, personnel, and testing environments, may be limited. As a result, testing efforts may prioritize high-impact features or core functionalities, with less attention given to newer or less critical features.

4. Beta Testing: Some BIM software tools rely on beta testing programs to gather feedback from users before officially releasing new features. While beta testing can help identify issues and gather user feedback, it may not cover all possible scenarios or edge cases.

5. User Diversity: BIM software users have diverse workflows, preferences, and project requirements. It can be challenging to anticipate all the ways in which users might interact with a new feature or the different environments in which it may be used.

4.5 FINDINGS:

In the study green building and conversional building as been compare by the doing number of irradiative trails with the help of in bit plugging and tools in BIM software such as auto desk Revit 2022 and auto desk incite the study

- Bench mark in green building is compare less than conversional building 20.3$ and 19.0$ USD per M/S per year and 20.3 USD M/S per year was observe .
- Model history in USD M/S was found oppumals for green building in compare with conversional building.

GREEN BUILDING **NORMAL BUILDING**

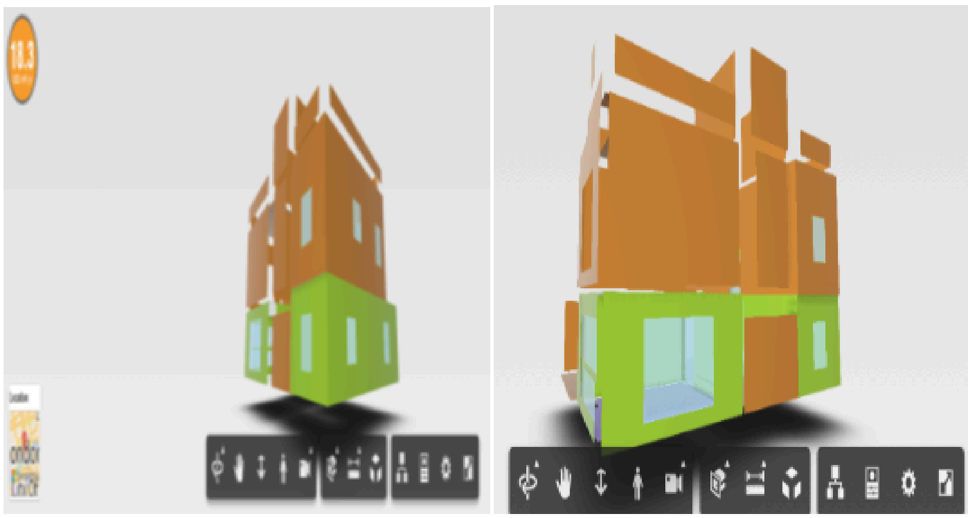


Figure: 4.5.1

Figure: 4.5.2

GREEN BUILDING **NORMAL BUILDING**

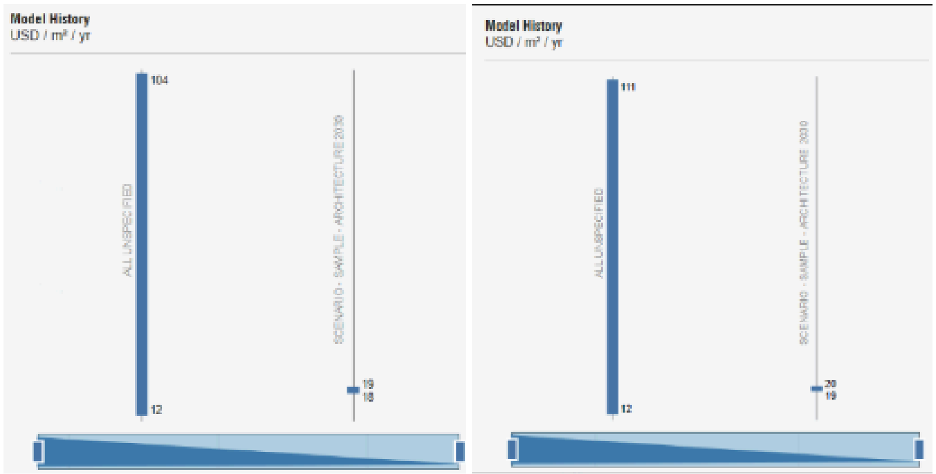


Figure: 4.5.3

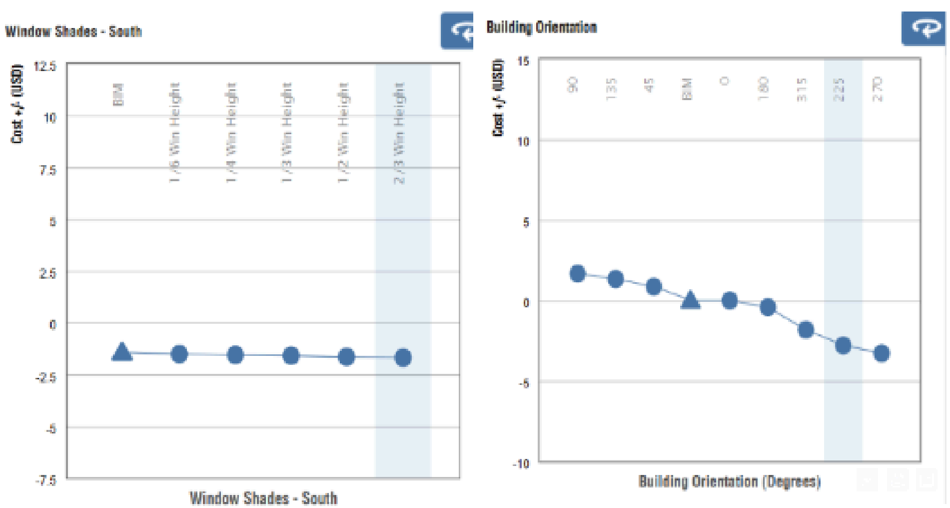


Figure: 4.5.4

GREEN BUILDING **NORMAL BUILDING**

Figure: 4.5.5

Figure: 4.5.6

GREEN BUILDING **NORMAL BUILDING**

Figure: 4.5.7

Figure: 4.5.8

GREEN BUILDING **NORMAL BUILDING**

Figure: 4.5.9

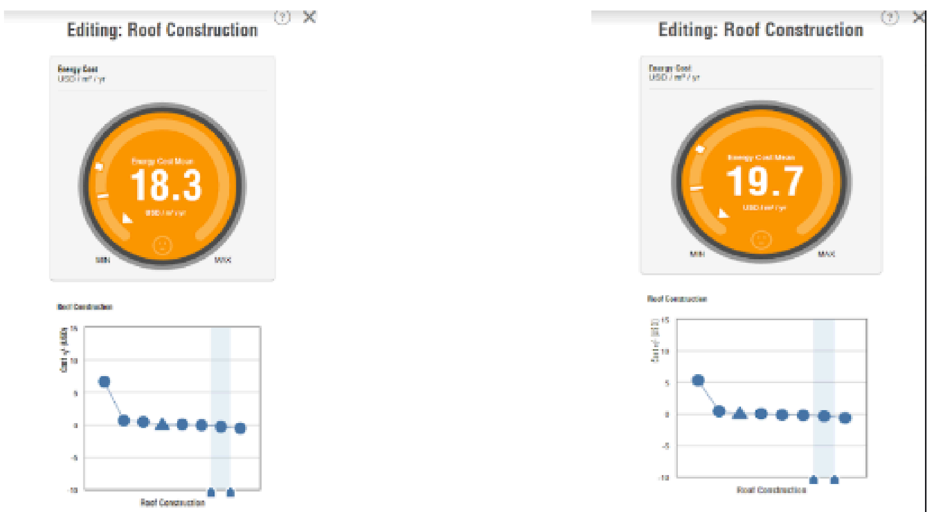


Figure: 4.5.10

GREEN BUILDING **NORMAL BUILDING**

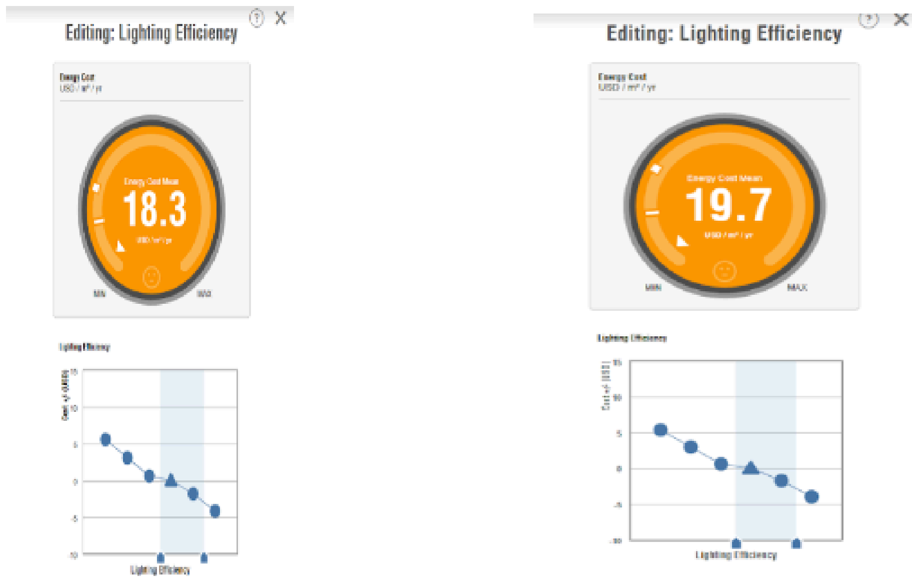
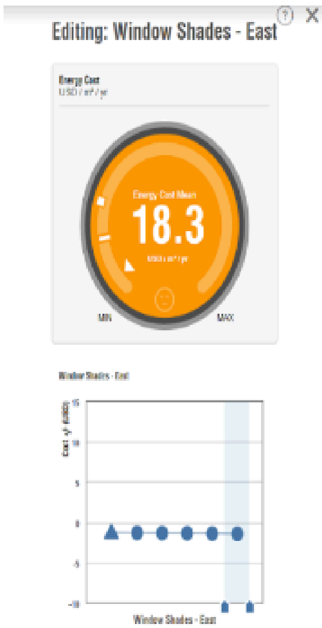


Figure: 4.5.11

Figure: 4.5.12

GREEN BUILDING **NORMAL BUILDING**



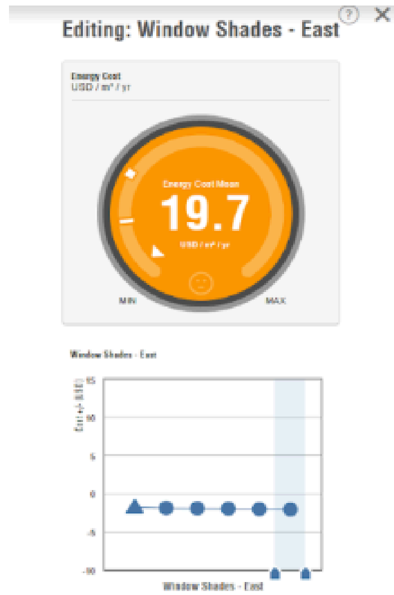


Figure: 4.5.13

CHAPTER 5

BUSINESS ASPECTS

THE MARKET AND ECONOMIC OUTLOOK OF CAPSTONE PROJECT FOR COMPARATIVE STUDY & MODELLING OF COVENTIONAL & GREEN BUILDING USING BIM

5.1 Market Growth: The adoption of BIM technology has been steadily increasing across the construction industry due to its ability to improve collaboration, efficiency, and project outcomes. The market for BIM software and services is expected to continue growing as more companies recognize the benefits of digital transformation in construction.

5.1.1 Industry Trends: Emerging trends such as digital twins, augmented reality (AR), virtual reality (VR), and cloud-based collaboration are reshaping the landscape of BIM. Capstone projects that incorporate these trends may attract interest from industry stakeholders looking to stay ahead of the curve.

5.1.2 Regulatory Requirements: Many governments and regulatory bodies are mandating the use of BIM for public infrastructure projects to improve transparency, reduce costs, and enhance project delivery. Capstone projects that address compliance with BIM standards and regulations could align with market demand.

5.1.3 Technological Advancements: Advancements in BIM software capabilities, such as artificial intelligence (AI), machine learning, and advanced analytics, are opening up new possibilities for innovation in construction project management, scheduling, and optimization. Capstone projects that leverage these technologies could attract attention from industry professionals seeking cutting-edge solutions.

5.1.4 Economic Conditions: Economic factors, such as GDP growth, construction spending, interest rates, and labor availability, can influence the demand for BIM services and solutions. A strong economy with robust construction activity may create favorable conditions for capstone projects in BIM, whereas economic downturns may pose challenges.

5.1.5 Competitive Landscape: The BIM market is competitive, with multiple software vendors and service providers vying for market share. Capstone projects that differentiate themselves through unique value propositions, innovative features, or niche focus areas may stand out in the crowded market.

5.1.6 Global Reach: BIM adoption varies across regions and countries, with some markets more mature than others. Capstone projects with a global perspective that address the needs of diverse markets could appeal to multinational companies.

5.2 Highlight the Novel features of the "COMPARATIVE STUDY & MODELLING OF COVENTIONAL & GREEN BUILDING USING BIM"

5.2.1 Integrated Environmental Analysis: BIM allows for the integration of environmental analysis tools directly into the modeling process. This enables real-time evaluation of various green building strategies, such as passive design techniques, renewable energy systems, and sustainable materials, to assess their impact on energy efficiency, indoor environmental quality, and overall sustainability.

5.2.2 Parametric Design Exploration: BIM facilitates parametric design exploration, allowing designers to quickly iterate through different design options and evaluate their performance against sustainability metrics. By linking design parameters to performance indicators, such as energy consumption, daylighting levels, and thermal comfort, designers can optimize green building designs for maximum efficiency and sustainability.

5.2.3 Life Cycle Assessment (LCA): BIM enables life cycle assessment (LCA) of building materials and systems, considering their environmental impacts across all stages of the building life cycle, from extraction and production to construction, operation, and end-of-life disposal. This holistic approach to sustainability evaluation helps identify opportunities for reducing embodied carbon, minimizing resource consumption, and enhancing overall environmental performance.

5.2.4 Energy Simulation and Analysis: BIM integrates energy simulation and analysis tools that enable detailed energy modeling of buildings to predict energy consumption, demand, and costs. By simulating different energy-efficient strategies, such as passive design, HVAC optimization, and renewable energy integration, designers can make informed decisions to reduce energy use and carbon emissions while improving occupant comfort and building performance.

5.2.5 Green Building Certification Support: BIM can streamline the process of achieving green building certifications, such as LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment Environmental Assessment Method), by providing tools to track and document compliance with sustainability criteria. Automated reporting features help streamline certification documentation and verification, saving time and resources for project teams.

5.3 How Does the product\service fit into the competitive landscape

5.3.1. Sustainability Focus: The product/service emphasizes sustainability as a core component of building design and construction. In a market increasingly concerned with environmental impact and resource efficiency, offering a comprehensive comparative study and modeling approach that evaluates green building strategies can differentiate the product/service from competitors focused solely on conventional building methods.

5.3.2. Technological Innovation: Leveraging BIM technology for comparative study and modeling demonstrates a commitment to technological innovation and advanced methodologies. By harnessing the power of BIM tools for parametric design exploration, energy simulation, life cycle assessment, and collaborative decision-making, the product/service provides a more sophisticated and data-driven approach to building analysis than traditional methods.

5.3.3. Comprehensive Analysis: The product/service offers a comprehensive analysis of impact, occupant comfort, and lifecycle cost. By considering these factors holistically and providing actionable insights to optimize sustainability outcomes, the product/service delivers added value to clients seeking to maximize the long-term benefits of their building investments.

5.3.4. Efficiency and Accuracy: Using BIM for comparative study and modeling enhances efficiency and accuracy compared to manual or disjointed approaches. Automation features, parametric modeling capabilities, and integrated analysis tools streamline the design process, reduce errors, and enable rapid iteration of design options. This efficiency gains a competitive edge by delivering high-quality results in

5.3.5. Certification Support: The product/service supports green building certification processes, such as LEED or BREEAM, by providing tools to track and document compliance with sustainability criteria. This feature appeals to clients seeking to achieve certification for their projects and simplifies the certification process by automating documentation and reporting tasks.

5.4 Describe Ip or Patent issues

5.4.1. Ownership and Rights: BIM projects often involve multiple parties collaborating on a single model, such as architects, engineers, contractors, and owners. Determining ownership and rights to the BIM model and the data within can be complex. It is essential to establish clear agreements on who owns the model and any specific IP rights from the outset.

5.4.2. Licensing and Access: The parties involved in a BIM project must agree on how the model and its associated data will be shared and accessed. Licensing agreements can dictate the terms under which the different parties can use, modify, or distribute the BIM model and related data.

5.4.3. Copyright Issues: BIM models may incorporate copyrighted materials, such as designs, software, or other digital content. Using these materials in a collaborative environment can lead to potential copyright issues if not properly managed.

5.4.4. Patents: BIM-related technologies, such as specific software features or tools, may be covered by patents. It's important to be aware of any existing patents that may apply to the technologies being used in a BIM project to avoid potential infringement.

5.4.5. Data Protection: BIM models often contain sensitive data, such as building designs, operational data, or personal information. Ensuring that this data is protected and used in compliance with data protection laws is essential.

5.5 Who Are The Possible Capstone Projected/customers

5.5.1. Architects: Architectural firms often use BIM to create detailed designs and visualizations. They may require BIM models to collaborate with engineers and other specialists, as well as to present plans to clients.

5.5.2. Engineers: Structural, civil, and MEP (mechanical, electrical, plumbing) engineers use BIM to design and analyze various systems within a building. They may benefit from detailed models to identify potential issues and optimize their designs.

5.5.3. Contractors and Builders: Contractors use BIM models for construction planning, scheduling, and coordination. They can benefit from the project by streamlining processes and minimizing potential construction issues.

5.5.4. Owners and Developers: Building owners and real estate developers use BIM for facility management and to ensure that buildings meet specific standards and requirements. They may request BIM models to facilitate maintenance and operations after construction is complete.

5.5.5. Facility Managers: Facility managers use BIM models for the ongoing operation and maintenance of a building. They may need detailed models that include asset data and building information.

5.6 FINANCIAL CONSIDERATIONS

5.6.1 Capstone Project Budget

5.6.1.1 Software and Tools: The cost of acquiring BIM software and any additional tools or plugging required for the project.

5.6.1.2. Hardware: Costs associated with acquiring or upgrading hardware, such as high-performance computers and servers, for efficient BIM modeling.

5.6.1.3. Data and Resources: Acquiring or licensing data, such as GIS data or building product models, needed for the project.

5.6.1.4. Team and Labor: Compensation for team members involved in the project, including architects, engineers, and BIM specialists. This may include salaries, wages, or stipends for students working on the capstone project.

5.6.15.Training and Development: Costs associated with training team members in BIM software and processes, including workshops or courses.

5.6.2 Cost Capstone Projections Needed For Either for Profit/non Profit Options

Profit-Driven Projects

5.6.2.1. Project Planning:

Detailed analysis of potential revenue streams, including BIM services offered.

Assessment of market demand and competition.

5.6.2.2. Cost Components:

Software licenses and tools, as well as hardware costs.

Labor costs, including salaries and benefits for team members.

Marketing and sales expenses to attract customers and secure contracts.

Overhead costs, including office space and utilities.

5.6.2.3. Profitability Metrics:

Calculate ROI, profit margins, and break-even points.

Identify areas where BIM processes can reduce costs or improve efficiency.

5.6.2.4. Scalability and Growth:

Consideration of future opportunities for growth and scaling services.

Investment in additional resources or technology to meet demand.

5.6.3 Non-Profit-Driven Projects

5.6.3.1. Project Planning:

Define the mission and objectives of the project.

Assess community needs and identify potential funding sources, such as grants or donations.

5.6.3.2 Cost Components:

Software and hardware costs may be offset by donations or academic partnerships.

Labor costs may include volunteers, stipends, or work-study arrangements.

Administrative expenses should be kept to a minimum.

5.6.3.3. Funding Sources:

Seek grants, donations, or sponsorships to support the project.

Consider partnerships with educational institutions or government agencies.

5.6.3.4. Impact Metrics:

Focus on social, environmental, or educational outcomes.

Measure success based on community engagement, educational impact, or sustainable design.

5.6.3.5. Efficiency and Cost-Saving Measures:

Leverage open-source tools and community resources.

Minimize waste and utilize BIM to optimize design and construction processes.

Conclusion

Reference

Certainly! "Green building" refers to the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle. If you're looking for references on green building, here are a few reputable sources:

1. U.S. Green Building Council (USGBC): This organization is widely recognized for its Leadership in Energy and Environmental Design (LEED) rating system, which provides a framework for identifying and implementing green building design, construction, operations, and maintenance solutions.

2. Green Building Councils (GBCs) Worldwide: Many countries have their own Green Building Councils that offer resources, certifications, and guidance specific to their regions. Examples include the Canada Green Building Council, Green Building Council Australia, and Singapore Green Building Council.

3. International Living Future Institute (ILFI): ILFI promotes the concept of regenerative design and offers the Living Building Challenge, a certification program that goes beyond LEED in terms of sustainability requirements.

4. World Green Building Council (WorldGBC): This global network of Green Building Councils provides resources, research, and advocacy to promote sustainable building practices worldwide.

5. The Environmental Protection Agency (EPA): The EPA offers resources and tools related to green building, including the ENERGY STAR program for energy-efficient buildings and appliances.

6. Books and Academic Journals: There are numerous books and academic journals dedicated to green building topics, ranging from introductory guides to advanced research publications. Some well-regarded titles include.