Erudite Journal of Engineering Technology and Management Sciences
Vol. 4, No. 3, September 2024, pp. 38-43
Journal homepage: http://www.ejetms.com

# Modelling and Layout of G+4 Residential Building using AutoCad and 3ds Max Software

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https://doi.org/10.5281/zenodo.14505675

**Received:** 15 August 2024
**Accepted:** 22 September 2024

***Keywords:***
*2Ddrawings, 3Dvisualization, Architectural works*

**ABSTRACT**

The Design and Modelling of G+4 Residential Building using 3ds Max for 3D Modelling, Rendering and AutoCAD for drafting. To ensure representation of the G+4 Residential Building, AutoCAD is first utilized to develop full floor plans, elevations, and structural layouts. The 2D drawings are then transformed into realistic 3D models using 3ds Max, which adds textures, lighting, and materials to the visualization to create an aesthetic representation of the interior and exterior designs. The technical drawing capabilities of AutoCAD and the rendering capability of 3ds Max are combined to create realistic presentations and efficient design development, which aids in effectively communicating the design vision to clients.

## 1. INTRODUCTION

The design and construction of residential buildings require careful planning, precise execution, and effective communication between architects, engineers, and clients. With advancements in technology, the design process has evolved significantly, incorporating powerful software tools that enhance the accuracy, visualization, and overall quality of the construction process. One such technological advancement is the use of computer-aided design (CAD) software like AutoCAD and 3ds Max, which allow architects to model, simulate, and visualize complex building designs before they are constructed. This project focuses on the modelling and layout of a G + 4 residential building using AutoCAD and 3ds Max software. The term "G + 4" refers to a building with a ground floor and four additional floors, typically seen in urban residential developments. The main objective of this study is to utilize AutoCAD for the detailed creation of architectural plans and layouts, followed by the use of 3ds Max to provide realistic 3D visualizations of the building, ensuring the design is both functional and aesthetically pleasing.

AutoCAD is a versatile and widely-used tool in the field of architecture and engineering, known for its precision in creating 2D and 3D designs. It allows architects to create detailed floor plans, elevations, and sections, ensuring that the design adheres to the necessary building codes and specifications. 3ds Max, on the other hand, is a leading 3D modelling and rendering software that enhances the design process by offering photorealistic rendering capabilities, virtual walkthroughs, and dynamic visualizations. These visualizations allow clients, designers, and construction teams to better understand the final look and feel of the project before construction begins. By integrating both AutoCAD for layout design and 3ds Max for 3D modeling and rendering, this project aims to provide a comprehensive approach to architectural design. The process will involve creating accurate building layouts, including the ground floor and upper floors, designing the structural elements, and then transforming these designs into detailed, realistic 3D visualizations. The use of these tools not only helps improve the accuracy of the design but also facilitates communication and collaboration among stakeholders, ensuring that the final building design meets all the functional, aesthetic, and regulatory demonstrating how AutoCAD and 3ds Max can streamline the design process, improve decision-making, and deliver high-quality residential buildings that align with the needs of the residents and the community.

## 2. LITERATURE

Workflow in Virtual Reality Tool Development for AEC Industry by, Pratima and Dos sick, Mutis, I.[3] (2019) investigates how Architecture, Engineering, and Construction (AEC) firms integrate virtual reality (VR) technology into their workflows, particularly during design and pre-construction

phases. The study identifies the main use of VR in AEC as building walkthroughs, supported by a variety of software tools ranging from quick, off-the-shelf solutions to in-house developments tailored to specific needs. Through semi-structured interviews, the authors analyze the challenges and workflows of VR implementation, highlighting how modern VR systems enhance visualization while requiring customized solutions for features like model annotation and multi-user environments.

Feasibility of augmented reality technology for communication in the construction industry. Advanced Engineering Informatics. Harikrishnan, A, Abdallah, AS, Ayer, SK, El Asmar, M and Tang, P 2021[4]: This research explores the use of virtual reality (VR) technology to enhance architectural education, specifically in building construction courses at Jordan University of Science and Technology (JUST), which traditionally rely on teacher-centred methods. The study developed BC/VR software that uses a 4D model (3D model with time) to simulate construction phases, providing immersive and non-immersive experiences for students. Through a structured questionnaire, the study evaluates the effectiveness of this VR tool in providing building construction information, increasing student enjoyment, and integrating with other courses. Results indicate that VR technology significantly outperforms traditional methods in all areas. The research also highlights VR's evolution and its potential to transform educational approaches by offering more interactive and engaging learning experiences

Kelly L. Murdock is the author of "Autodesk 3ds Max 2021 Complete Reference Guide." This book is highly regarded for its comprehensive coverage of 3ds Max, making it suitable for both beginners and experienced users. It includes over 150 tutorials and step-by-step instructions on various topics, such as crowd simulation, particle systems, and MAXScript1.

The Complete Reference Guide is the ultimate book on 3ds Max, and like Autodesk's 3D animation software, it just gets better and better with each release. Whether you're new to 3ds Max or an experienced user, you'll find everything you need in this complete resource. The book kicks off with a getting started section, so beginners can jump in and begin working with 3ds Max right away. Experienced 3ds Max users will appreciate advanced coverage of features like crowd simulation, particle systems, radiosity, MAX Script and more. Over 150 tutorials – complete with before and after files – help users at all levels build real world skills.

Pradeep Mamgain is the author of "Autodesk 3ds Max 2021: Modelling Essentials, 3rd Edition." This book provides a structured approach to learning 3D modelling with 3ds Max, starting with the basics and progressing to more advanced techniques. Pradeep Mamgain is a self-taught digital artist, instructor, and consultant with a strong background in computer graphics. he Autodesk 3ds Max 2022 Fundamentals provides a thorough introduction to the Autodesk 3ds Max 2022 software that will help new users make the most of this sophisticated application, as well as broaden the horizons of existing, self-taught users.The guide instructs you on how to effectively use the software interface and navigate through the scenes. It explores the creation of 3D objects and how to bring in objects from other software such as Autodesk Revit, AutoCAD, and Civil 3D. Additionally, it teaches you to prepare the scenes for renderings by adding materials, lights, and cameras. Finally, the guide covers an understanding of various renderers included with the software, as well as image creation and animation techniques. The practices in this guide are primarily geared towards real-world tasks encountered by users of the Autodesk 3ds Max software in the Architecture, Interior Design, and Civil Engineering industries. Advanced topics such as character modelling, character animation, and rigging are not covered in this guide.

Rick Bartholomew is an interior designer with over forty years of practicum experience in residential, commercial, and furniture design. He has a Bachelor of Architecture and Master of Science (Interior Design) degrees from Oklahoma State University, of which, he formerly served as a professor teaching in the Interior Design program in the Department of Design, Housing, and Merchandising. Professor Bartholomew was tenured at OSU during his seventeen years of teaching experience. Rick currently conducts hand sketching and rendering workshops for schools of interior and architectural design, and one-on-one workshops for professional design .rick's area of specialization is furniture design and presentation techniques. He has designed furniture pieces for exhibition and gallery showrooms in Oklahoma, Arizona, New Mexico, New York, Houston, and Chicago in addition to ownership of a copyrighted furniture collection inspired by Native American history and culture. Rick was a design consultant for a national retail fixture and custom furnishings manufacturer and his current work includes working with design and furniture manufacturing firms in developing furnishings and furniture components, as well as conducting sketching and colour rendering workshops across the country passion, in addition to furnishings design, is dedicated to teaching students and practitioners the art and necessity of hand sketching techniques and colour marker and watercolour rendering illustrations. He also strives to foster the importance of quality visual presentation composition and information graphics. His is personally inspired by Native American history and culture, the work of Frank Lloyd Wright, Georgia O'Keeffe, Nicolai Fechin, Art Deco, and contemporary design.

Hazard Recognition in an Immersive Virtual Environment: Framework for the Simultaneous Analysis of Visual Search and EEG Pattern and Kevin Hanh D 2020[13]: A virtual safety training system using immersive virtual environments (IVE) to enhance workers' hazard recognition skills in construction sites. Workers wear virtual reality (VR) devices equipped with eye-tracking and brainwave-sensing technology to identify hazards in simulated construction settings. The platform analyses workers' performance in hazard recognition tasks and provides personalized feedback, identifying areas where additional intervention is needed. This approach offers new insights into how a worker's brain and eyes function together during hazard recognition and aims to improve safety training by providing tailored, real-time feedback to workers.

Understanding Different Views on Emerging Technology Acceptance between Academia and the AEC/FM Industry, Yong Keen and steven Ayer 2019[14]: This study examines the technology maturity gap between academia and the construction industry, focusing on how both sectors accept and reject emerging technologies differently. Through a partnership with the Construction Industry Institute's Horizon-360 team, the study surveyed academic research and the architecture, engineering, construction, and facilities management (AEC/FM) industry to assess their views on various technologies. The results highlight differences in how academia and industry perceive the relevance and maturity of these technologies. The findings aim to facilitate more active

collaboration between academia and industry in adopting emerging technologies.

Application of virtual reality for infrastructure management education in civil engineering, Arif, F 2021[15]: This study explores the use of Virtual Reality (VR) in teaching infrastructure management to civil engineering students. A bridge inspection module was developed for a Cave Automatic Virtual Environment (CAVE) system at NED University. The study involved 69 senior-year students enrolled in a structural design course, who provided feedback through structured assessments. Results indicated that students had better focus in VR environments and found the experience engaging, comfortable, and easy to use. The study suggests that more exposure to VR can improve students' learning experiences, though real-world applications may require advanced modelling techniques, such as LIDAR scanning, to address hidden structural damages.

Mark Gerhard Author of "Mastering Autodesk 3ds Max Design 2011," which provides comprehensive tutorials and real-world examples for architectural visualization using 3ds Max. He has co-authored several books, including "Mastering Autodesk 3ds Max Design 2011" and "Mastering Autodesk 3ds Max Design 2010". These books provide comprehensive tutorials and real-world examples for architectural visualization and 3D modelling using 3ds Max1. Mark Gerhard's works are well-regarded for their detailed instructions and practical approach to teaching 3ds Max design techniques.Mark Gerhard has also contributed to various online tutorials and training materials, helping both beginners and experienced users to master the software. His works are appreciated for their clear explanations and step-by-step instructions, making complex concepts more accessible.

Jeffrey Harper Co-author of "Mastering Autodesk 3ds Max Design 2011," offering step-by-step instructions and professional workflows.

Gobin Peng, Yueqing He, Yu Sun, and Kai Xi Zhou: Authors of a conference paper titled "Three-Dimensional Game Modelling and Design Research Based on 3Dmax Software," which explores the application of 3ds Max in game design are authors known for their research on three-dimensional game modelling and design using 3ds Max software. They are affiliated with the Design and Art College at Guilin University of Electronic Technology in China1. Their work focuses on exploring the application of 3ds Max in game development, highlighting its powerful modelling functions and user-friendly interface.Their research paper, titled "Three-Dimensional Game Modelling and Design Research Based on 3Dmax Software," delves into various modelling approaches and techniques within 3ds Max, aiming to improve design efficiency and qualityA Brief Discussion on Augmented Reality and Virtual Reality in Construction Industry, Ahmed, S, Hossain, MM and Hoque, MI 2017[27]: The construction industry is undergoing significant transformation with the adoption of Augmented Reality (AR) and Virtual Reality (VR) technologies. This study explores how AR and VR are revolutionizing the sector by addressing key challenges such as project scheduling, progress tracking, quality control, defect management, and communication among project participants. These technologies also enhance safety management, worker training, and project visualization, allowing stakeholders to virtually experience projects before construction begins. Despite their benefits, AR and VR face implementation challenges, but ongoing technological advancements are expected to overcome these limitations. The study concludes that AR and VR will increasingly play critical roles in improving safety, quality, efficiency, and time management in the construction industry.

Divyaraj Sinh M. SOLANKI et. al 2023[1] The study highlights the transformative role of Virtual Reality (VR) and Augmented Reality (AR) in civil engineering, improving construction processes, education, and project management. These technologies enable efficient design and planning, early error detection, and collaboration, reducing costs by 43-45% for project mock-ups. VR enhances education with immersive environments and virtual site visits, while 2D plans can be converted into 3D interactive models for sustainable marketing and sales. VR and AR are poised to revolutionize civil engineering, delivering significant economic, educational, and operational benefits. .

Yue Pan et. al 2021[7] Artificial intelligence (AI) applications in construction engineering and management (CEM), focusing on both scientometric and qualitative analyses. The review explores the current state of AI adoption in CEM by analysing 4,473 journal articles published between 1997 and 2020, highlighting a surge in research over the past decade. Key areas of AI's impact on CEM include automation, risk mitigation, efficiency, and digitalization, with a particular emphasis on six hot research topics: knowledge representation, information fusion, computer vision, natural language processing, optimization, and process mining. The paper also identifies six future research directions smart robotics, cloud VR/AR, AIoT, digital twins, 4D printing, and blockchains that aim to enhance automation and intelligence across the construction project lifecycle. The study underscores AI's transformative potential in improving labor productivity, safety, and overall project performance in the construction industry.

Delgado et. al 2020[12] This paper presents a study on the current use of augmented reality (AR) and virtual reality (VR) in the architecture, engineering, and construction (AEC) sectors and proposes a future research agenda. The study involved workshops and surveys with 54 experts from 36 organizations. Based on the data, six key use-cases for AR and VR in AEC were identified: stakeholder engagement, design support, design review, construction support, operations management, and training. The paper suggests three main research areas: engineering-grade devices for harsh construction environments, efficient workflow and data management, and the development of new capabilities to meet specific industry needs. The study aims to provide a foundation for practitioners to make informed adoption decisions and a roadmap for researchers to guide future efforts in AR and VR applications in AEC.

Michelangelo Scorpio et. al 2020[13] This study examines how immersive virtual reality (IVR) can improve smart city lighting design by addressing both technical and user-centered factors. Traditional tools focus on photometric parameters but overlook subjective user responses like comfort and emotional impact. IVR allows designers to create realistic, interactive virtual environments for evaluating lighting systems in key urban areas such as roads, green spaces, and buildings. Using the Unreal game engine, the study highlights VR’s ability to incorporate both objective and subjective lighting criteria, demonstrating its potential to enhance user-focused lighting designs. While VR shows promise, further research is needed to ensure its reliability in accurately simulating lighting effects. The paper emphasizes IVR’s role in creating innovative and collaborative lighting solutions for smart cities.

Yong K. Cho et. al 2019[14]: This study examines the technology maturity gap between academia and the construction industry, focusing on how both sectors accept and reject emerging technologies differently. Through a partnership with the Construction Industry Institute's Horizon-360 team, the study surveyed academic research and the architecture, engineering, construction, and facilities management (AEC/FM) industry to assess their views on various technologies. The results highlight differences in how academia and industry perceive the relevance and maturity of these technologies. The findings aim to facilitate more active collaboration between academia and industry in adopting emerging technologies.

## 3. METHODOLOGY

The methodology adopted in this study focuses on the design, modelling, and visualization of a G + 4 residential building using AutoCAD and 3ds Max software. The combined approach of using AutoCAD for 2D drafting and 3ds Max for 3D modelling and rendering ensures both functional precision and realistic visualization, providing stakeholders with a comprehensive understanding of the building's design. This methodology is structured in systematic phases to ensure efficiency, accuracy, and detailed representation throughout the design and construction process. The design process begins with a thorough site analysis, including the measurement of the plot, surrounding infrastructure, and environmental factors such as orientation, sunlight, and local zoning laws. This analysis helps determine the building's layout and overall design. Based on the site analysis and client specifications, the layout of the residential building is planned. Key considerations include room sizes, functionality, and flow, along with ensuring that all design aspects comply with applicable building regulations. The building's layout is initially developed in AutoCAD, beginning with the ground floor and extending to the four upper floors (G + 4). This includes: Defining room sizes and placements, including living rooms, bedrooms, kitchens, and bathrooms. Positioning of structural elements like walls, columns, doors, windows, and staircases. Incorporating MEP systems (Mechanical, Electrical, Plumbing), with detailed provisions for piping, wiring, and ventilation. After completing the floor plans, elevations (front, rear, and side) are drawn in AutoCAD to represent the vertical proportions and aesthetic elements of the building. Cross-sections through the building are also created to represent spatial relations between different levels. CDetailed construction drawings are developed, providing accurate dimensions, material specifications, and structural details, forming the basis for construction. 3D Modelling and Visualization (3ds Max). The 2D floor plans and elevations created in AutoCAD are imported into 3ds Max, where they are used as references to create the building's 3D model. The model begins with basic structural components such as walls, floors, and the roof. The layout of each floor is meticulously constructed, ensuring alignment with the original AutoCAD plans. Once the basic structure is in place, interior walls, windows, doors, furniture, and finishes are modelled. The exterior features, including facades, balconies, and landscaping, are also developed. Max, realistic textures are applied to surfaces, such as brick, concrete, wood, and glass, to simulate actual construction materials. Custom textures are created to enhance the visual accuracy of the design. Realistic lighting is set up in 3ds Max, including natural light (sunlight) and artificial lighting (indoor fixtures), to simulate real-world illumination. Rendering settings are adjusted to achieve high-quality visual output, taking into account shadows, reflections, and material properties. Once the 3D model is complete, high-quality renders are generated using V-Ray or Corona Renderer. These renderers simulate real-world lighting, textures, and materials to produce photorealistic images of the building from various camera angles. The rendered images are then imported into Adobe Photoshop for post-processing. Adjustments to color balance, contrast, sharpness, and overall image quality are made to enhance the visual appeal of the final renderings. Depending on the scope of the project, a virtual walkthrough or animation can be created in 3ds Max. This provides stakeholders with a dynamic, interactive view of the building, allowing for a 3D exploration of the interior and exterior spaces. The design, including both 2D AutoCAD drawings and 3D visualizations, is presented to the client and other stakeholders (such as architects and engineers) for review. This stage allows for feedback on the functionality, aesthetics, and feasibility of the design. Based on the feedback, the design is refined in AutoCAD or 3ds Max. Modifications may include adjustments to space planning, structural elements, or materials. The finalized AutoCAD drawings, including floor plans, elevations, sections, and structural details, are prepared for construction. These documents are used by contractors to build the residential structure. The high-quality renders and any animations or walkthroughs are delivered to the client for final approval, offering a realistic preview of the completed building.

## 4. RESULTS AND DISCUSSION

Figures shows the result of the layout of the G+4 Residential building using AutoCAD and 3ds max software.

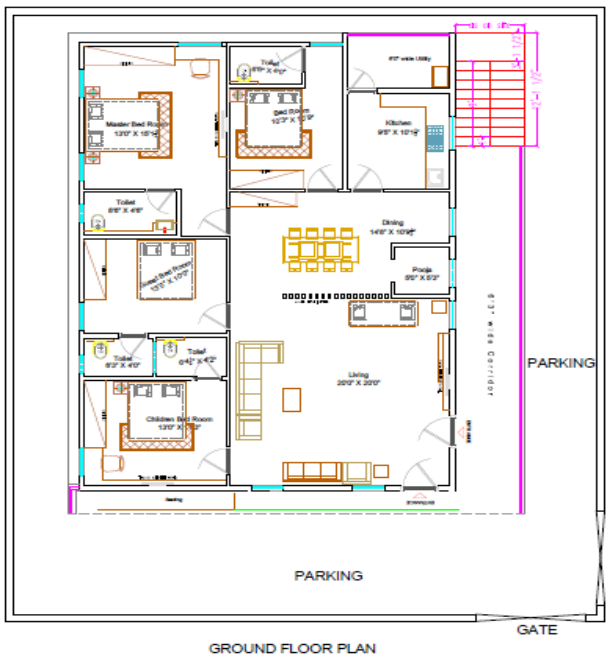


**Figure 1.** Ground floor plan of house design.

The ground floor layout illustrates key functional zones, including parking areas, entry points, and primary living spaces. The design focuses on maximizing accessibility and

efficient circulation, providing a seamless integration of indoor and outdoor areas.

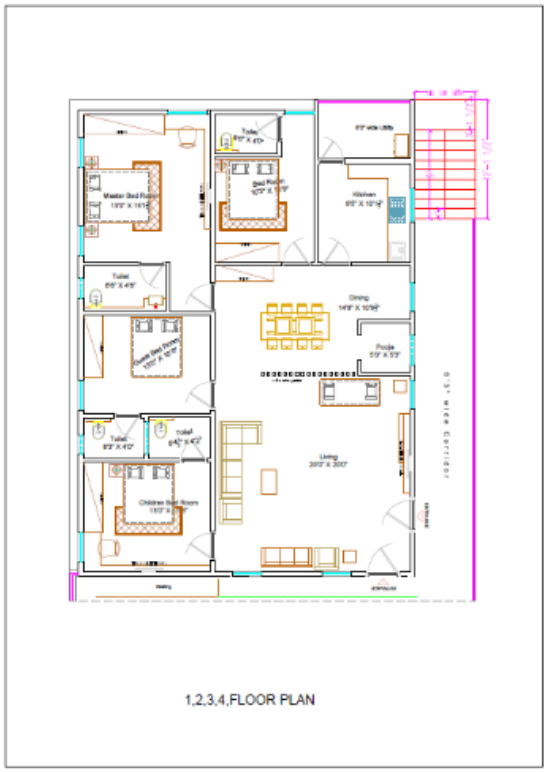


**Figure 2.** 1,2,3,4 floor plans of G+4 Residential building

The layout depicts the design of the 1st to 4th floors, featuring functional spaces such as living rooms, dining areas, kitchens, bedrooms (master, children's, and guest), and associated utility spaces. The plan ensures optimal spatial arrangement for comfort, accessibility, and functionality.

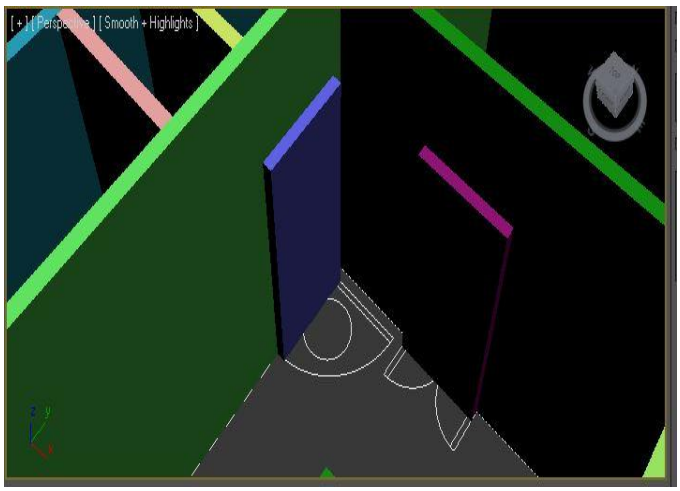


**Figure 3**. Shows the interface of 3ds max design of the our project**.**

**Figure 4.** 3D Model of G+4 Residential Building

Designed using 3ds Max, this model illustrates a modern G+4 residential building with vibrant facades, spacious balconies, and functional design, suitable for urban living.

## 5. CONCLUSION

The use of AutoCAD and 3ds Max in the design and modelling of a G + 4 residential building has proven to be an effective approach for creating detailed, accurate, and visually compelling architectural designs. AutoCAD provided precise 2D floor plans, elevations, and construction documentation, ensuring the structural integrity and functionality of the building. 3ds Max enhanced the design through realistic 3D modelling, texturing, and high-quality renderings, enabling immersive visualizations that allowed stakeholders to better understand the building's layout and aesthetics. The integration of both software tools facilitated efficient design iterations, improved client communication, and provided a comprehensive final model that is ready for construction. This methodology demonstrates the power of combining technical precision with realistic visualization to achieve a successful residential building design.

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