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Planning, Designing, Analysis of Residential Building (G+10) by BIM Software and Hybrid Method of Construction

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Abstract: ***This project is a comprehensive study of planning, designing, analysis of a residential building (G+10) by using BIM software and hybrid methods of construction such as the combination of mivan alufrom and conventional brickwork by timber formwork and various other things such as the software like AutoCAD, Revit, Staad pro, naviswork, etc. This project contains a deep study of various softwares which are to be used like autocad, revit, staad pro, naviswork , etc to make a ideal residential building using these softwares we have to use the softwares for planning, designing, analysis of the building which consist of doing 2D drafting of the plan then 3D of the plan in revit and then analysis of the same in staad pro and also naviswork quantity estimation along with cost estimation of it. To do all the things we first need to use the Autodesk Autocad software for 2d drafting of the plan of the residential building and then we have to use the AutoDesk Revit software for doing the 3D modelling of the same building and also to do the rendering and walkthrough of G+10 residential building. Now for the analysis part of the building we have to use the Bentley STAAD PRO software to do the design of column, beam, slab and also to put the loading of dead load, live load, wind load, etc. To do this we have to follow some procedures like firstly we have to prepare a 2D line plan of the drafted plan in autocad then we have to decide where the columns, beams, and slab will be located in the building structure. Then for the loading part of it we have to define load cases and then select the area of city/town for doing the wind analysis and for live loads and dead loads we have to define some factors for the loading assignment after the loading cases are defined we have to do have assigning of the loads which will be done like on lower floors there will be more loading but as we go up in the height there won't be much loading because when we go higher and higher the amount of loading gets decreased so we have to give sizes accordingly. Then for the wind analysis part of the building we have to define the zone/area in which we will do the analysis of wind. It will be done in the staad pro software as well as by reviewing various research papers and IS codes for standard values of the same.***

Keywords—

1) ***Autocad***
2) ***Revit***
3) ***Staad pro***
4) ***Hybrid method (Study Base)***
5) ***conventional method, mivan aluform***
6) ***BIM***
7) ***Cost effective, increased strength, increased durability, long life of structure***

I. INTRODUCTION

The construction industry has seen a lot of changes recently, thanks to new technology and more efficient building methods. One of the biggest advancements has been the rise of Building Information Modeling (BIM) software. BIM allows architects, engineers, and contractors to create detailed digital models of buildings before they are even built, which helps to make the entire process more efficient and accurate. By simulating different scenarios, BIM can spot potential issues early on, reduce waste, and save both time and money, which is especially important for large projects. When it comes to planning and designing a G+10 residential building—a structure with a ground floor and 10 additional stories—there are many factors to consider. These buildings are often complex, with many floors, different types of spaces, and intricate structural systems. BIM can help design teams navigate these challenges. Software tools like Revit and Navisworks allow users to create detailed 3D models, which not only help with visualizing the design but also enable simulations for things like structural performance, energy efficiency, and even cost estimation.

This level of planning is crucial to ensure the project runs smoothly and on budget. Alongside the use of BIM, a hybrid construction approach that combines traditional construction methods with newer technologies is becoming more popular. One such method is Mivan Aluform, a type of modular formwork made from aluminum. It speeds up the construction process by providing pre-fabricated molds for concrete, reducing labor time and improving precision. When combined with more traditional construction techniques, such as reinforced concrete and masonry, this approach allows for faster, more efficient building without compromising on quality or safety. For a G+10 residential building, combining BIM with hybrid construction methods presents a unique opportunity to improve the planning, design, and construction process. BIM ensures the design is feasible, cost-effective, and structurally sound, while Mivan Aluform helps speed up the actual construction. This combination can lead to a more efficient building process, reducing time and costs while improving the quality of the final structure. This paper explores how BIM software and hybrid construction methods can be used together in the design and planning of G+10 residential buildings. It will look at how these tools help streamline the construction process, solve design challenges, and ultimately create better, more efficient buildings in today's fast-paced urban environments.

II. AIM AND OBJECTIVES OF PROJECT

A. Aim

To design a residential building for the small builders and make it cost effective using hybrid construction methods.

B. Objectives

1. To design the residential building which is cost effective.
2. To design the residential building which uses hybrid technique of construction by combining conventional and mivan methods.
3. To design the residential building which is made using BIM softwares.
4. To design the residential building which is suitable for any scale of work.
5. To learn the various softwares which are in BIM also along with the various methods of the construction.

C. Problem Statement

In the construction industry the small builders struggle to use the mivan aluform due to high initial cost and lack of knowledge so we are trying to do a hybrid of conventional method which is very well known along with the mivan company ltd. aluform which is well known for the big builders and is used for the high scale projects for G+18 and above and for small scaled work it is considered to be G+3 to G+10 in india there are usually small scaled projects so we decided to do this project for small scale buildings and also a G+10 residential building and make it cost effective for the small builders as well the big builders present in india. It is to be done by using various softwares as listed above and the various methods also listed above we will follow standard procedures and methods as per the Is code and also refer some research papers and videos to make it happen

D. Need And Necessity Of Work

The Mivan technique is far better than the traditional method of construction of the beam, column, and slab and other structural members and other members of the structure due to it being made of aluminum formwork the formwork is reusable and also gives better finish. Mivan formwork also helps to achieve more strength and durability in the structure by supporting the structure until it is fully settled in a place which also results in better and consistent finish overall the parts of structure including the walls, beam, column and the slab. Mivan technique uses the monolithic approach of construction of the structure which involves casting of structural members at once by placing the formwork at a time then pouring the concrete in the formwork at once to cast the various components of that structure. Conventional method of construction which uses the timber formwork for casting of concrete member which is not only less reusable but also gives improper finish and may give bad odour as well after being used a few times.

III. LITERATURE REVIEW

1) Plan and Design of a Residential Building:

Bholanath Kalia1, Kallalamaya Patra2, Durga Prasad Mohapatra3, Rajesh Kanar4, Ananya Punyotyoa Parida5 1, 2, 3, 4Student, Civil Engineering, Gandhi Institute For Technology, Bhubaneswar, Odisha, India. 5Professor, Department of Civil Engineering, Gandhi Institute For Technology, Bhubaneswar, Odisha, India.

Abstract: Generally, building is a structure that provides basic shelter for the humans to conduct general activities. In common prose, the purpose of buildings is to provide humans a comfortable working and living space and protection from the extremes of climate.

However, a building usage depends on the lifespan and the change of rate effected on their impact on efficiency of use.

2) Review Paper on Analysis and Design of Residential G+4 Building by Using STAAD Pro:

Prajakta Hepat1, Gaurav Bhoyar2, Sumedh Kamdi3, Vedant Fasate4 Department of Civil Engineering KDK college of Engineering, Nandanvan Nagpur, Maharashtra, 440009

Abstract: It is important for designers to save time in order to be competitive in the increasingly competitive market. There are many ways to examine different frames using paper and pencil, such as the kani's method, cantilever method, the portal method and the matrix method. However, with the help of the integration of various engineering methods, the determination of various changes in the calculation text (i.e. text-based), durability, and deformation are failures caused by hidden objects has changed and brought this system to a new level. STAAD PRO (Structural Analysis and Design) is a software that integrates all large-scale analysis, static, dynamic, linear and nonlinear, especially for residential analysis and design. Our project "G+4 Inspection and Design of Residential Buildings Using STAAD PRO Software" is an attempt to inspect and design buildings using STAAD PRO. In this study, the construction of G+4 buildings is discussed. Inspection by static method and design as per IS 456:2000 guidelines. Content - co-loading, multiple stories, analysis, design, STAAD Pro; Keywords: Dead Load, Live Load, Multi-Storied Building, Analysis, Design, STAAD Pro

3) Comparative Analysis Between Conventional and Mivan Construction

Prof. Ghatol C. B, Tanishka S. Nimbalkar, Arjun Pale, Ashish Kharat, Kalpesh Kharat, Kamal Dulat, Rajan Ahire Professor, Department of Civil Engineering, MGM's Polytechnic, Chh. Sambhajinagar, Maharashtra, India Student, Department of Civil Engineering, MGM's Polytechnic, Chh. Sambhajinagar, Maharashtra, India

ABSTRACT: This study presents a comparative analysis between conventional construction methods and Mivan construction techniques using the ETABS software. Conventional construction methods typically involve the use of formwork made of wood, steel, or other materials, while Mivan construction employs lightweight aluminium formwork systems. The aim of this analysis is to evaluate the structural performance, construction efficiency, and economic viability of both construction methods. The analysis is conducted using ETABS software, a widely used structural analysis

IV. METHODOLOGY

Our methodology consists of collecting the list of various methods, materials, and softwares needed for the project of residential building (G+10).

LIST OF SOFTWARES;

1) Autodesk Autocad
2) Autodesk Revit
3) Bentley Staad Pro
4) Excel

LIST OF METHODS:

1) Conventional
2) Mivan company ltd.

COMBINATION OF VARIOUS METHODS:

combination of mivan company ltd. and conventional method (brickwork) now the combination of the methods will be done like the structural components will be casted using the mivan aluform. method of construction and the non structural components are to be done by using the conventional methods of construction.

After the combination of both the methods are done we will do the cost effective analysis of the same using navisworks software and also ms excel software to decide the optimal quantity, cost and materials of the building using navisworks software.

1) Conventional method:

The method of construction uses the timber formwork and brickwork with mortar to make the building and it also uses the various methods such as the conventional concrete and timber formwork in specific sizes.

a) Aluform:

The aluform construction consists of monolith construction technique to construct the building in which the building structural components at once and then the non structural members at once using aluform and some admixtures.

b) Monolith technique:

the monolith construction is a technique which does the construction of structural components using the casting of structural members at once and then the non structural members separately using aluminium formwork

c) Various materials needed:

the mivan method uses the aluminium formwork and conventional concrete with/without the admixtures and other chemicals

d) What is exactly hybrid construction?

Firstly lets understand what is hybrid so hybrid is combination of methods or materials to make a ideal building . so we are making the combination of mivan aluform and conventional method of construction to make a G+10 residential building.

Benefits of hybrid construction:

- increased speed
- increased durability
- cost effective in the long run
- easy to assemble and disassemble
- suitable for every building construction
- suitable for small builders
- enhanced life of structure

Disadvantages of hybrid construction:

- It requires greater knowledge in the construction field
- It requires more cost in the initial stage of work
- it requires high level of experience to do execution of work
- it needs more skilled labours and engineers/supervisors to monitor and execute the project

What are the software with their specifications:

- Autodesk autocad:

This software is mainly used for the drafting of 2D plan of a building and also its elevations and sections to show the various details and materials to be used while construction of the building

- Autodesk revit

This software can also be used for the 2D drafting, elevations and section of the building but along with that it is also used for the purpose of 3D view, applying various materials doing interior work and also the rendering and walkthrough of the building

- Bentley staad pro:

This software is used for the design of beams, columns, slab plates and also it is used for defining the loads and their forces with the wind analysis of the same,

- Navisworks:

Navisworks Is Used For The Quantity And Cost Estimation Also The Cost Effectiveness Of The Same By Using This Software We Can Easily Estimate The Cost And Also See If Its Cost Effective Or Not

V. CONCLUSIONS

From this project we learned about various bim related softwares and also with their applications and functions and the various softwares being the autodesk autocad, autodesk revit, autodesk navisworks, bentley staad pro, etc. These softwares helped us to plan, design and analyze the g+10 residential building from scratch which includes doing the complete planning, designing and analysis of the residential building and also to do the estimation of it as well. The outcomes of our project are that we successfully designed/made a g+10 residential building using various software of building information modelling (bim) and also made use of the hybrid method of construction.

The work is done as follows

VI. RESULTS AND ANALYSIS

1) REVIT Model

FIG. 1. REVIT SOFTWARE MODEL PHOTO

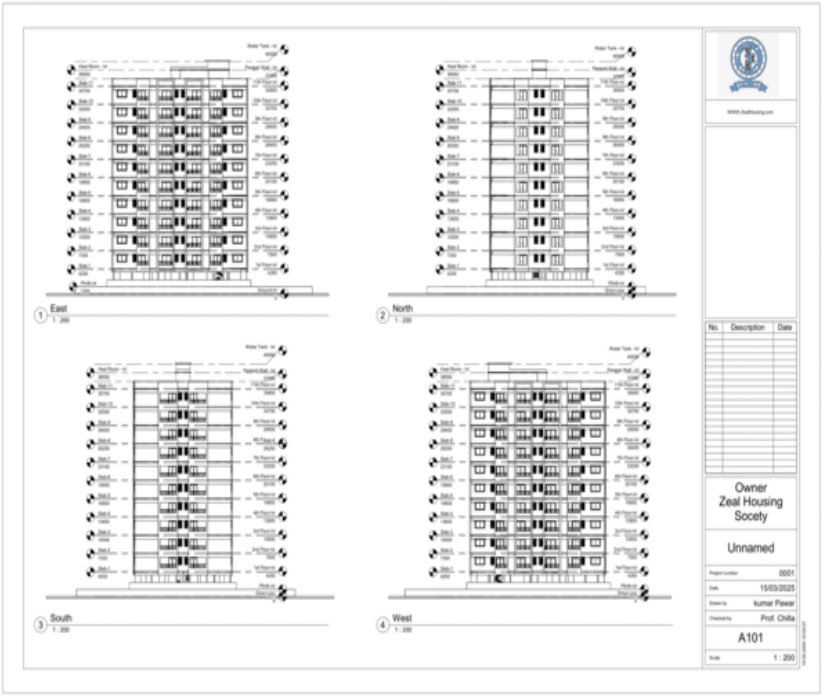

FIG. 2. REVIT PLAN ELEVATION

2) AUTOCAD FLOOR PLAN

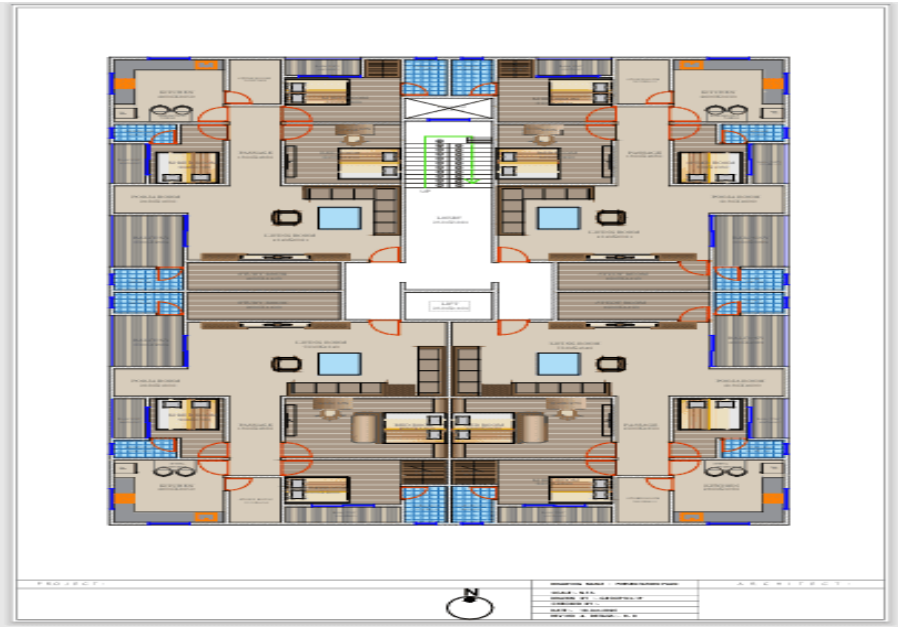

FIG. 3. AUTOCAD SOFTWARE FLOOR PLAN PHOTO

3) STAAD PRO PHOTOS:

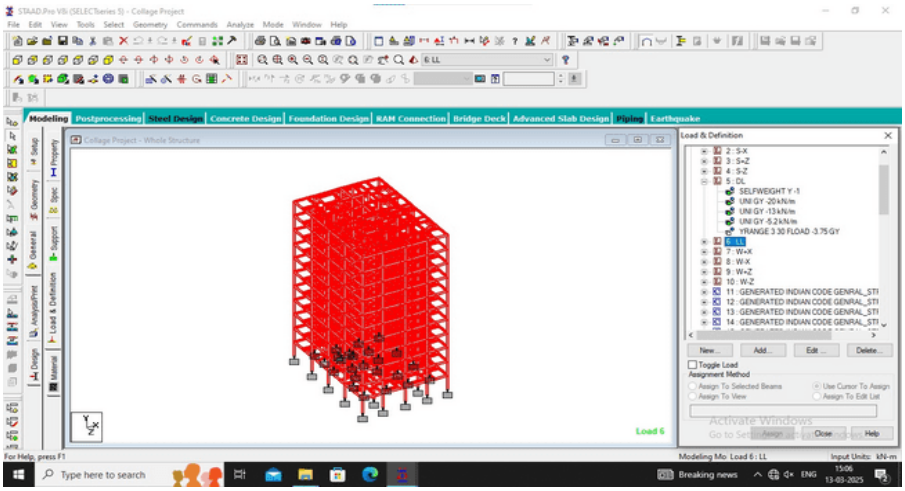

FIG. 4. DEAD LOAD ANALYSIS

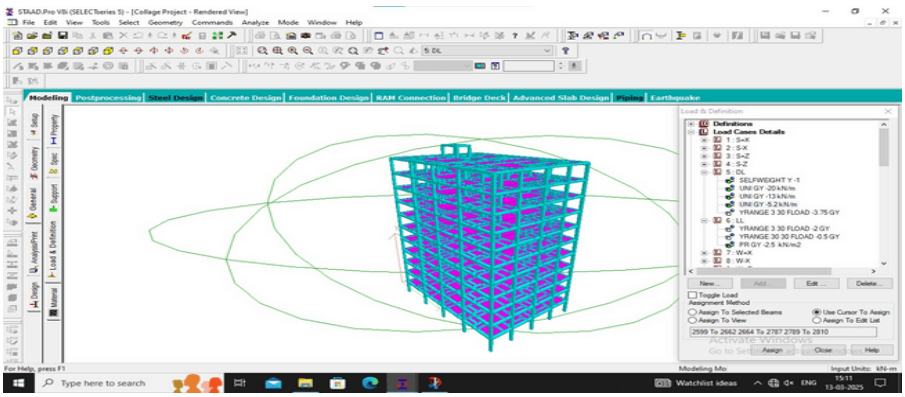

FIG. 5. WIND LOAD ANALYSIS

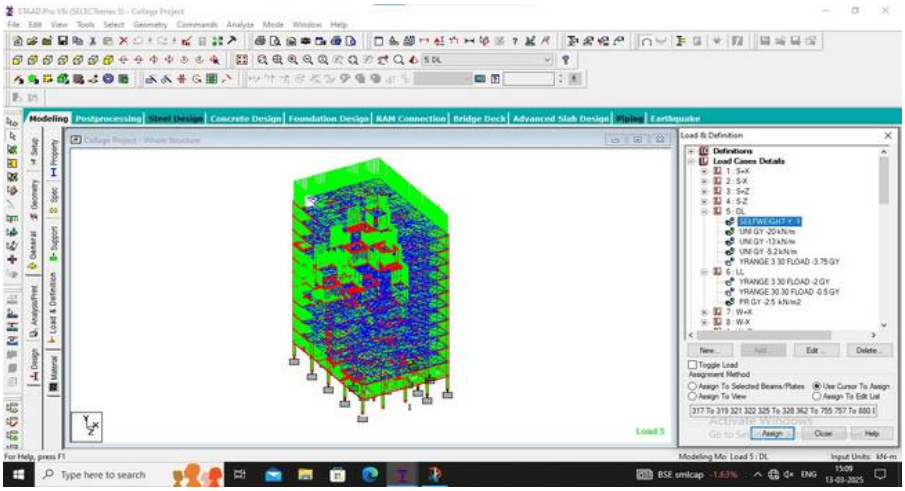

FIG. 6. FLOOR LOAD ANALYSIS

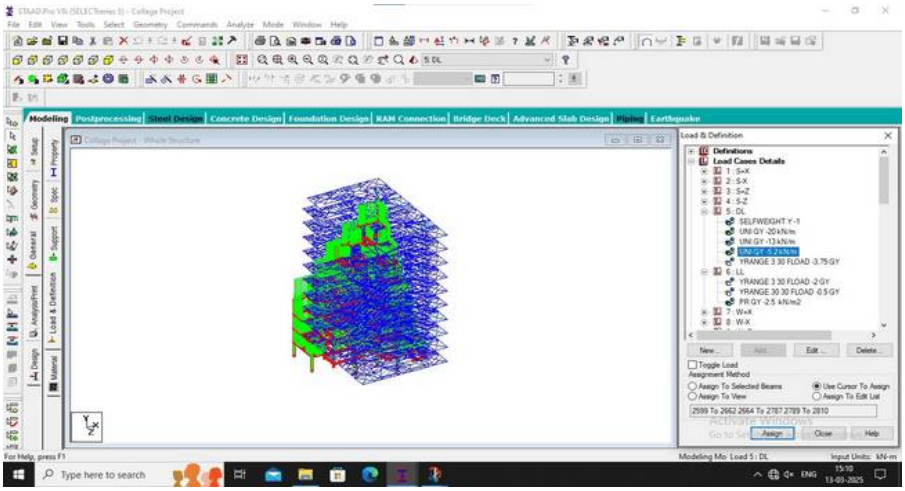

FIG. 7. FLOOR LOAD ANALYSIS

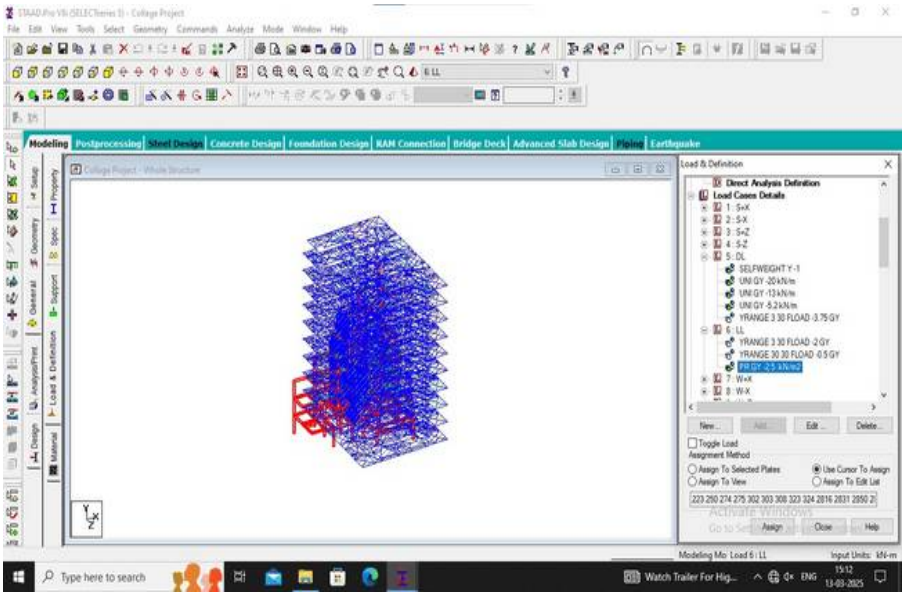

FIG. 8. PLATE LOAD ANALYSIS

VII. ACKNOWLEDGMENT

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[9] Comparative Analysis Between Conventional and Mivan Construction using Etabs Software Prof. Ghatol C. B, Tanishka S. Nimbalkar, Arjun Pale, Ashish Kharat, Kalpesh Kharat, Kamal Dulat, Rajan Ahire Professor, Department of Civil Engineering, MGM's Polytechnic, Chh. Sambhajinagar, Maharashtra, India Student, Department of Civil Engineering, MGM's Polytechnic, Chh. Sambhajinagar, Maharashtra, India

[10] Planning, Designing and Detailed Estimate of G + 1 Frame Structure Tejashree Kiran Shinde1, Darshan Ramakant Thakare2, Pradnya Vishwas Pawar3, Rudraksha Krushna Borse4, Sakshee Dipak Sandanshiv5, Nimesh Dilip Chaudhari6, Prof. S. Y. Sonawane7, Prof. N. R. Borase8 1, 2, 3, 4, 5, 6UG Student of Civil Engineering Department, Gangamai College of Engineering, Nagaon 7Assistant Professor, Civil Engineering Department, Gangamai College of Engineering, Nagaon 8Head, Civil Engineering Department, Gangamai College of Engineering, Nagaon

[11] MIVAN Construction Technology: Enhancing Efficiency and Quality in Precast Structural Elements Prof. Santosh Mahadev Kinayekar1, Prof. Sukant Kumar Chauhan 2, Prof. Kamran Ahmed3, Sneha Sharad Bagrao4, Vaijayanti Jayawant Kadav5, Aishwarya Pandit6, Varunraj Jayawant Bader 7 Assistant Professor, Department of Civil Engineering, Alamuri Ratnamala Institute of Engineering and Technology, Shahapur, Thane, Maharashtra, India1,2,3 U.G. Student, Department of Civil Engineering, Alamuri Ratnamala Institute of Engineering and Technology, Shahapur, Thane, Maharashtra, India4,5,6,7

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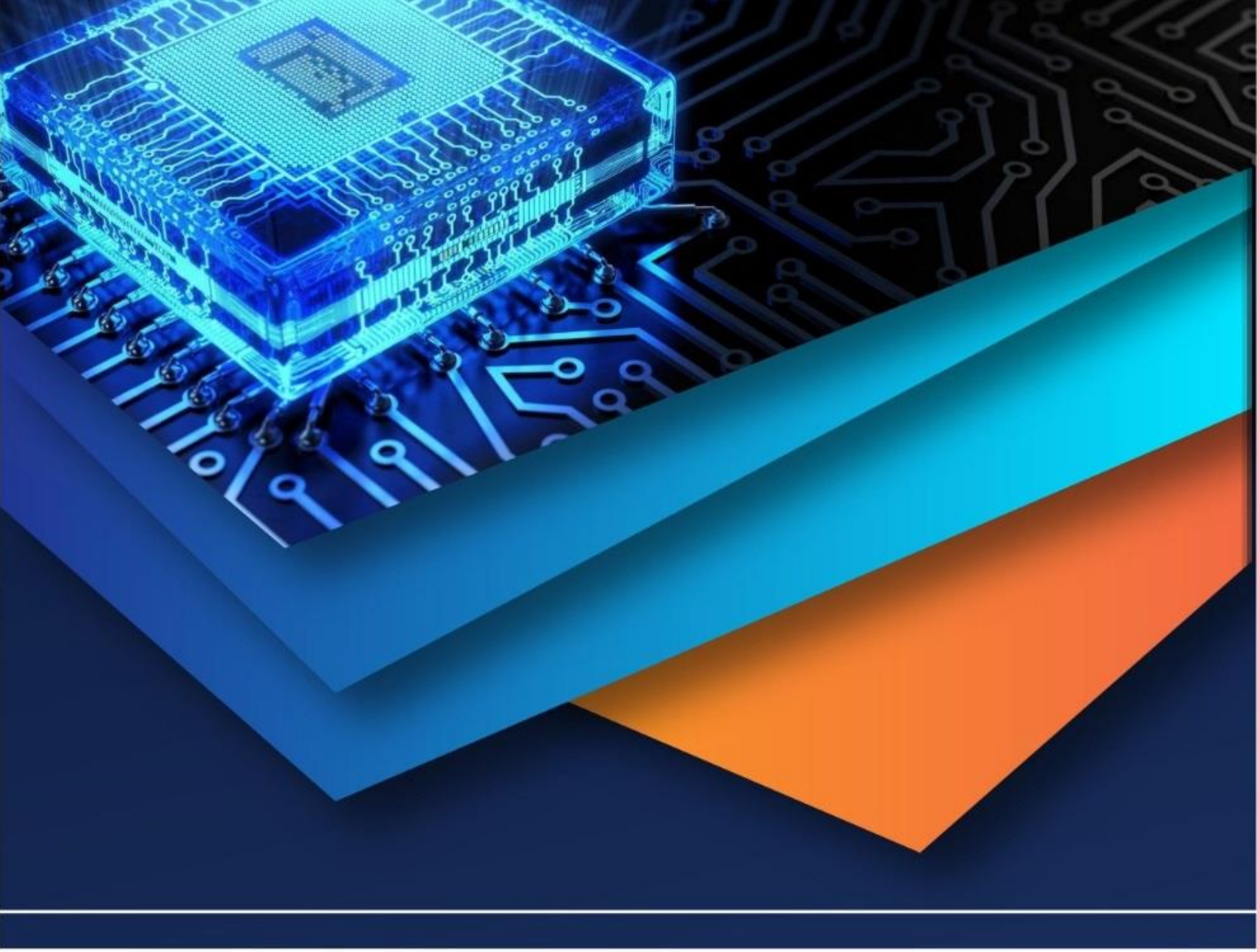
[13] Planning, Designing and Estimation of G+2 Residential Building using Autocad and STAAD PRO Dr. G.T. Naidu1, Kolli Devi2, Vasupalli Dunesh3, Dadi Bhanu Prasad4, Margana Charan Naga Sai5, Veda Gayatri Yedla6 1Head of Department, 2, 3, 4, 5Student, Civil Engineering, DR. Lankapalli Bullaya College of Engineering



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