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Design and Analysis of Commercial G+4 Building by using STAAD.PRO

[a]G.Maniknata, [a]K.Akshay, [a]M.Abhilash. [b]Kasi Reddy Prathap Reddy.

[a] U.G. Student, Department of Civil Engineering,, Guru Nanak Institutions Technical Campus, Ibrahimpatnam, Telangana, India.
[b] Assistant Professor, Department of Civil Engineering, Guru Nanak Institutions Technical Campus, Ibrahimpatnam, Telangana, India.

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ABSTRACT

I The main objective of this project is to design a G+4 commercial building with verandah by using STAAD PRO V8i. The design includes load calculation and analysis of structure by using STAAD Pro software and input generated AUTO CAD based file. In this project we had analysis G+4 commercial building in "L" shape and find out shear force, bending moment, deflection, maximum absolute and reinforcement details of different component of the structure. The load applied on structure are Dead Load, Live Load and total height of the building is 15 m and area of each floor is approximate 381.52 m^2.

1. INTRODUCTION

STAAD-PRO is a structural analysis design software, it includes a state of the art user interface, visualization tools and international design codes. It is used 3D models generation, analysis and multi material design, the commercial version of STAAD PRO supports several steel, concrete and timber design codes, it is the software application created to help structural engineer to automate their task and remove the tedious and long procedure of the manual calculation for designing method. In this project there is a commercial building G+4 in "L" shape having 8 rooms in one direction and 6 rooms in other direction of size 3.8×4.35 m with verandah on both direction. tructural engineering is the science and art of designing and making, with economy and elegance, buildings, bridges, frameworks and other similar structures so that they can safely resist the forces to which they may be subjected.

Accordingly, the study includes the structural design and analysis of a multi-storey building using STAAD.Pro V8i software, using different grade of concrete to determine which structure is economic with equal strength. Layout plan for the structure to be designed and analysis is finalised.

The layout includes 6 units of flats to be constructed on a single floor (as 1-3bhk, 3-2bhk and 2-1bhk), having extra spaces for lift, stair case and lobby for every flats. We use cement, sand, aggregate, and water which are mixed with a certain ratio, and concrete is cast and put in a cube of 150 mm size and put in a water bath for 28 days and afterwards, it is tested in a compression testing machine. The compressive stress result is known as the "grade of concrete". It is expressed in N/mm^2.

2. LITERATURE

1. Thompson, D. (2015). Design of Multistory Reinforced Concrete Buildings forEarthquake Motions: Thompson's work focuses on the specific challenges of designing multi-storied buildings to resist seismic forces. It offers practical design strategies, performance evaluation techniques, and case studies, making it an essential reference for engineers working in earthquake engineering and structural design.
2. FEMA. (2009). Designing for Earthquakes: A Guide for Architects and Engineers: This publication provides guidelines for designing buildings that can withstand seismic forces, emphasizing risk reduction and safety. It discusses engineering principles, design strategies, and best practices for creating resilient structures in earthquake-prone regions.
3. Ching, F. D. K., & Binggeli, C. (2018). Building Construction Illustrated: This comprehensive guide provides detailed illustrations and explanations of construction methods and materials, making it an invaluable resource for architects and engineers. It covers various aspects of building design and construction, including structural systems, materials, and environmental considerations, all presented in an accessible format that enhances understanding.
4. Taranath, B. S. (2013). Structural Analysis and Design of Tall Buildings: This book offers in-depth coverage of the principles and practices involved in designing tall buildings, including both steel and composite structures. Taranath emphasizes structural behavior under various loads, providing

readers with advanced analytical techniques and design strategies for high-rise construction.

[K. Prabin kumar, r. Sanjaynath, (2018)] this study is related to the design of a multi-storey building using staad.pro software. In this report the building is designed using limit state method and carried out using staad.pro software. The whole procedure is done according to software wise listings and the parameters are defined and designed according to is codes and norms. The building is planned as per is 456 2000. The checks performed are according to the procedure defined by the indian standards. In the project with the help of software different figures are taken into account from the software graphs and designs. Complete details are shown here related to stress and strain chats, etc.

[harshita m n, vinod kumar das, rajiv kumar chaudhary, sourabh singh, shivam shivhare, (2017)] this study is related to design and analysis of commercial building was done in etabs 2016. This project includes reinforced concrete frame structure (g+4) with parking facilities and the structure members are designed using limit state method as per is 456 2000. The building is planned as per is 456 2000. The checks performed are according to the procedure defined by the indian standards. Complete details are shown here related to stress and strain chats, etc.

[rashmi agashe, marshal baghele, vaishnavi deshmukh, sharad khomane, gaurav patle, kushal yadav, (april 2020)] from the work carried out in staad.pro we can conclude that: comparison between manual calculation and stadd.pro software analysis and design, conclude that the analysis is same but design is some different. Using staad.pro, analysis and design of multi-storey building has completed much quickly and easier than the manual calculation. Building plan was develop and draft in auto- cad with required dimension. During designing g+ 4 storeys residential building structure is capable to sustain all loads acting on building. The design of slab, beam, column, rectangular footing and staircase is done with is 456-2000 as limit state method.

3. METHODOLOGY:

3.1 Modelin G :

Preparing model of structure by using STAAD PRO software.

3.2 Calculation of load :

Dead Load calculation includes self-weight factor 1 KN/m, member load i.e. wall load 5 KN/m in GY direction and member load i.e. parapet wall load 1.5 KN/m in GY direction. Live load includes floor load in global Y direction range min 0 max 15 is 1.5 KN/m^2.

3.3 Analysis and design :

Analysis of bending moment, shear force, deflection and maximum absolute of beam, column and slab deliverables.

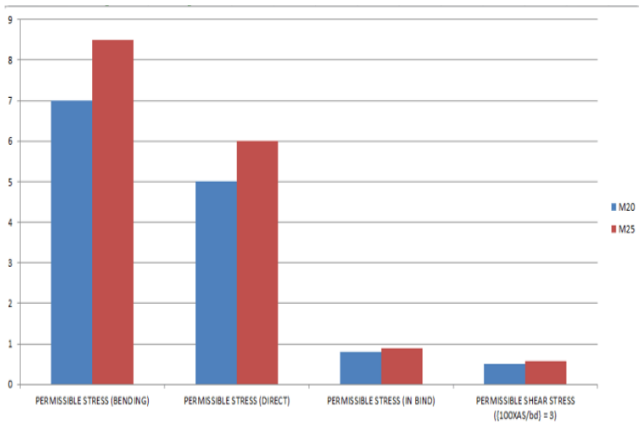
3. RESULTS AND DISCUSSION

We got the certain results from the above design, analysis and the comparison for the grade of concrete. They are:

1. Both the structures are safe and can be constructed.
2. The below table describes the warnings given:

No of beams under warning	Warning given
24 Members – 30, 35, 83, 88, 315, 320, 368, 373, 408, 413, 461, 466, 501, 506, 554, 559, 594, 599, 647, 652, 687, 692, 740, 745	Length to Depth ratio is less than 2.5. Deep beam is not designed and assuming it to be a part of a continuous beam and away from the critical section.

The permissible stresses indicates that M25 concrete is a better grade then M20 as shown:



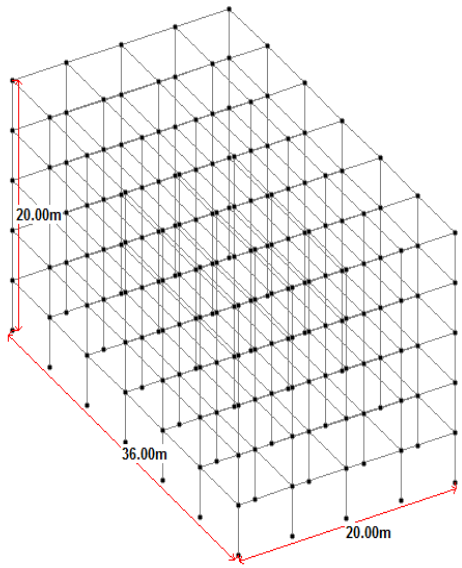


Figure 1. Staad Pro Frame Modelling of G+4 Commercial Building

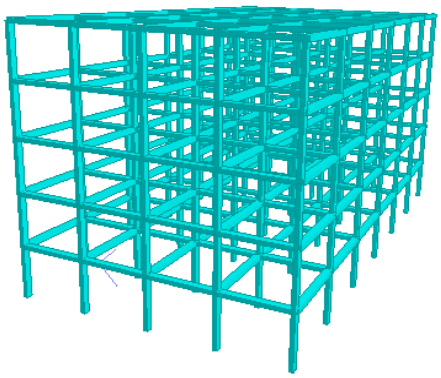


Figure 2. 3D Rendering view of G+4 Commercial Building

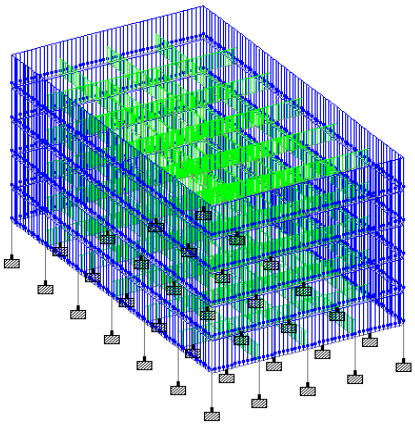


Figure 3. Dead Load on G+4 Commercial Buildin

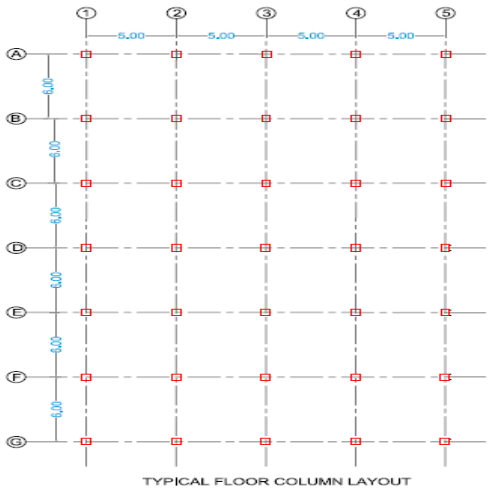
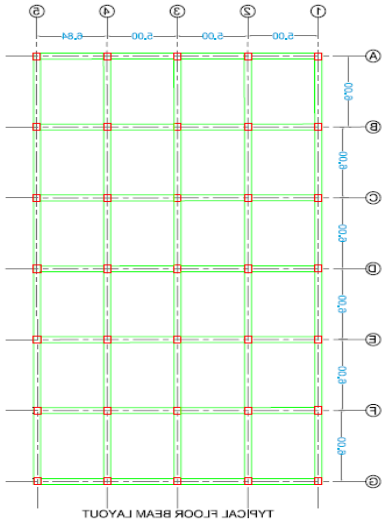


Figure 4. Typicall Floor Column Layout



4. CONCLUSION

Designing a farmhouse using 3ds Max software involves several key steps, starting with creating the basic structure of the house, including walls, windows, doors, and the roof. The software's powerful modelling tools allow for precise and detailed designs, making it possible to add intricate architectural elements and textures1. Users can also simulate real-world lighting conditions and materials to create realistic renderings of the farmhouse. The process typically includes: Modelling, Creating the basic structure and adding details such as windows, doors, and roofing. Texturing relates to applying materials and textures to give the model a realistic appearance. Lighting, setting up lighting to simulate different times of day and weather conditions. Rendering and Generating the final image or animation of the farmhouse. Overall, 3ds Max provides a comprehensive suite of tools for architectural visualization, making it an excellent choice for designing farmhouses and other structures. This study concludes that the structure designed by using the above data for nodes, beams, loads, frames, parameters, etc. is safe whether we design it by using M20 grade of concrete or using M25 grade of concrete. The analysis results are that both the structures are safe and can be constructed. While the comparison result shows that using different type of grade of concrete does not affect the volume of concrete but is severely affect the amount of steel used (mainly in the columns/vertical members). Therefore, we must completely analyse the project details and design results to clear out the economical betterment of the project.

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REFERENCES

1. Wang, P, Wu, P, Wang, J, Chi, HL and Wang, X 2018. A critical review of the use of virtual reality in construction engineering education and training. International journal of environmental research and public health, 15(6), 1204, https://doi.org/10.3390/ijerph15061204
2. Fogarty, J, McCormick, J and El-Tawil, S 2018. Improving student understanding of complex spatial arrangements with virtual reality. Journal of Professional Issues in Engineering Education and Practice, 144(2), 04017013.
3. Chen, Y., Li, Z., & Wang, X. (2019). Sustainable design of rural houses using computer-aided design. Sustainability, 11(10), 2811.
4. International Energy Agency. (2020). Energy Efficiency in Buildings.
5. Kumar, S., Kumar, R., & Sharma, A. (2018). Design and analysis of a farm house using AutoCAD and STAAD Pro. International Journal of Advanced Research in Computer Science, 9(3), 355-362.
6. Patel, J., Patel, S., & Patel, H. (2020). Design and modelling of a sustainable farm house using Autodesk Revit. International Journal of Sustainable Built Environment, 9(1), 1-11.
7. Singh, J., Singh, R., & Kaur, A. (2020). Design and analysis of a farm house using 3ds Max and STAAD Pro. International Journal of Advanced Research in Computer Science, 11(2), 147-155
8. Park, CS, Le, QT, Pedro, A and Lim, CR 2016. Interactive building anatomy modelling for experiential building construction education. Journal of Professional Issues in Engineering Education and Practice, 142(3), 04015019, https://doi.org/10.1061/(ASCE)EI.1943-5541.0000268
9. Akeem Pedro, Rahat Hussian, Anh-Tuan Pham hang, Hai Chien Pham 2019, Visualization Technologies in Construction Education: A Comprehensive Review of Recent Advances, River Publishers, 35, 9781003338130.
10. Thai-Thanh-Mai Pham, Quang-Vu Pham, Anh-Tuan Pham-Hang, Hai Chien Pham 2019, A Legal Framework and Compliance with Construction Safety Laws and Regulations in Vietnam, River Publishers, 39, ISBN9781003338130.
11. K Varney, M. Kusnir2019, Impact of flow rate on the water film thickness of water wall, CRC Press, 6, 9780429021596.
12. Bouska, R and Heralova, RS 2019. Implementation of virtual reality in BIM education. In Advances an