Planning, Designing And 3D Modeling Of Residential (Apartment) By Using BIM Software

Mr. Sujay Shelke[1], Mr. Pratik More[2], Ms. Shreya Kulkarni[3], Ms. Pooja Salunkhe[4], Prof. Pooja Kolla[5]
[1, 2, 3, 4] Dept of of Civil Engineering
[5]Assistant Professor, Dept of of Civil Engineering
[1, 2, 3, 4, 5] DYPCOE Akurdi, Pune-44

Abstract- *Any construction project to begin with starts with the layout of the building or structure followed by Design and Analysis of the structure which is succeeded by cost estimation and Planning for the project. Planning of any type of building is done by national building code (NBC) in India. This project involves the Planning, Design, Analysis, and Residential building (Apartment) Located near panache Vijapur road, Solapur. There's national highway connected very near to the plot. The total area of the site is about 3.15 acre. As it is rapidly developing the construction in the city is very costly, our country has most of population with the middle income group. So with the point of view we think that row house would be more reliable, cheaper, economical, and will have peaceful surrounding. We using very Popular Civil Engineering software's such as AutoCAD for Planning, STADD ProV8i for Analysis and Design, and Autodesk Revit for 3D Modeling.*

Keywords- Residential Building, STADD-PRO V8i, Autodesk Revit, NBC.

I. INTRODUCTION

Our main aim to complete a Multi-storey building is to ensure that the structure is safe against all possible loading conditions and to full fill the function for which they have built. Safety requirements must be met so that the structure is able to serve its purpose with the maintain cost. Detailed planning of the structure usually comes from several studies made by town planners, investors, users, architects and other engineers. On that, a structural engineer has the main influence on the overall structural design and an architect is involved in aesthetic details. For the design of the structure, the dead load, live loads, seismic and wind load are considered. The analysis and design for the structure done by using a software package STAAD PRO. In this project multistoried construction, we have adopted limit state method of analysis and design the structure. The design is in confirmation with IS456-2000.the analysis of one frame is worked out manually and simultaneously it has been checked using STAAD PRO. Therefore an attempt has been made to present the multistoried building for residential purpose in the busy city of Hyderabad. The complex consisting of five storeys. The structure is design based on the theory of LIMIT STATE METHOD which provides adequate strength, serviceability and durability besides economy.

Following are the objectives behind this study:

1. To get exposure to engineering experience and knowledge which are required on construction sites.
2. To gain exposure on engineering procedural work flow management.
3. To get responsibilities and ethics of engineers.
4. To achieve better design and planning for residential apartment development.

II. LITERATURE SURVEY

Major advances in both design and new material assisted roman architecture. Design was enhanced architectural developments in the construction of arches and roof domes. Arches improved the efficiency and capability of bridges and aqueducts (fewer supports columns were needed to support the structure), while domed roofs not only permitted the building of larger open areas undercover, but also lent the exterior an impressive. The social unit that lives in a house is known as a household. Most commonly, a household is family unit of a same kind, though households can be other social groups, such as single person, or groups of unrelated individuals. Settled agrarian and industrial societies are composed of household units living permanently in housing of various types, according to a variety of farms of lands tenure. English-speaking people generally call any building there routinely occupy "home". Many people leave their houses during the day for work and recreation, and return to them to sleep or for other activities.

1. LITERATURE-

   i. Name of Paper: Analysis and Design of Apartment Building
   ii. Name of Author:Nasreen M. Khan

iii. Publication: International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 3, March 2016.
iv. Objectives: 1.To share the experience gained from the "industrial training" in the discussion.

2. To get a feel of the work environment.

3. To apply engineering knowledge in real industrial situations
v. Software used: 1. STADD-PRO 2007, 2. AutoCAD 2016
vi. Conclusion: Analysis and design of an apartment building having G + 8 storeys is done. Analysis is done by using the software package STAAD Pro. V8i, which proved to be premium of great potential in analysis and design sections of construction industry. The structural elements like Ramp, shear wall and retaining walls are also provided. As per the soil investigation report, an isolated footing is provided. All the structural components were designed manually and detailed using AutoCAD 2016. The analysis and design was done according to standard specifications to the possible extend. The various difficulties encountered in the design process and the various constraints faced by the structural engineer in designing up to the architectural drawing were also understood.

2. LITERATURE-

i. Name of Paper: Design and Analysis of Residential Building
ii. Name of Author: Shaikh Ibrahim, MdArifuzzaman, Jisan Ali Mondal, MdTaukirAlam, SanuwarBiswas,Sagar Biswas
iii. Publication: International Research Journal of Engineering and Technology (IRJET).
iv. Software used: 1. STADD-PRO 2007, 2. AutoCAD 2016
v. Conclusion:After analyzing the G+4 storey building structure, concluded that structure is safe in loading like dead load, live load, wind load and seismic load. Member dimensions (Beam, Columnand Slab) are assigns by calculating the load type and its quantity applied on it. Auto-cad plan gives detailed information of the structure member's length, height, depth, size & numbers etc. STAAD PRO has the capability to calculate the reinforcement needed for any concrete section. The program contains a number of parameters which are designed as per IS:456-(2000). Beams are designed for flexure, shear and torsion and its give the detail number, position, spacing of reinforcement.

3. LITERATURE-

i. Name of Paper: Apartment Design Guide
ii. Name of Author: Rob Stokes
iii. Publication: NSW Department of Planning and Environment July 2015
iv. Objectives: 1.To improve the relationship of apartments to public domain including streets, lanes.
2. To support councils in developing planning controls and master plans through improved guidance.
3. To deliver design guidance and assist in the provision of more diverse housing mix.
v. Conclusion:This Apartment Design Guide is a resource to improve the planning and design of residential apartment development in NSW. It updates and replaces the Residential Flat Design Code introduced in 2002.

III. STATEMENT OF PROJECT

Salient Features: The design data shall be as follows.

1. Utility of Buildings: Residential Building
2. Area of each floor: 160 sq.m
3. No of Storey: G+5
4. Shape of the Building: Rectangular
5. No. of Staircases: Two
6. No. of Lifts: Two
7. Types of Walls: Brick Wall
8. Geometric Details:
Floor-To-Floor Height- 10'6" ft.
Depth of Foundation- 10'6" ft. below G.L
9. Material Details- Concrete Grade: M30,
All Steel Grades: HYSD REINFORCEMENT of Grade,
Fe500 Bearing Capacity of Soil: 200 KN/M2
10. Type of Construction: R.C.C FRAMED structure

IV. METHODOLOGY

1. **Building Byelaws & Principles:** Building Bye-Laws are legal tools used to regulate coverage, height, building bulk, and architectural design and construction aspects of buildings so as to achieve orderly development of an area. Formulated primarily by a central authority, building bye-laws ensure that constructions are not only safe but also adhere to aesthetic standards. ... For example, the rules prescribed under the building bye-laws can make it mandatory for builders to keep fire safety and earthquake-

resistance provisions at their projects. Organizations have bylaws because they want to maintain consistency in the running of the business. They use bylaws to communicate organizational rules so internal disputes and conflict can be avoided.

2. **Architecture:** Architecture is the art and science of designing buildings and structures. A wider definition would include within its scope also the design of the total built environment, from the macro level of creating furniture. In the field of building architecture, the skill demanded of an architect range from the more complex, such as for a hospital or stadium, to the apparently simpler, such as planning residential houses. Many architectural works may be seen also as cultural and political symbols, and /or work of art. The role of architect though changing, has been central to the successful design and implementation of pleasing built environments in which people live. Architectural is an interdisciplinary field, drawing upon mathematics, science, art technology, social sciences, politics, history and philosophy. Vitrifies states: "architecture is a science, arising out of many other sciences, and adorned with much and varied learning: by the help of which is judgment is formed of those works which are result of other arts" Most modern-day definition of "good buildings" recognize that because architecture does not exist in a vacuum, architectural form cannot be merely a completion of historical precedent, fictional necessities ; and socially aware concerns, but most also be a trance dents synthesis of all of the former and a creation of worth in and of itself. As Nunziarodanini stated, "through its aesthetic dimension architecture goes beyond the functional aspects that it has in common with other human sciences…through its own particular way of expressing values, architecture can stimulate and influence social life without presuming that, in and of itself, it will promote social development. To restrict the meaning of formalism to art for art's sake is not only reactionary; it can be a purposeless quest for perfection or originality which degrades fro, into a mere instrumentally". Architecture is both the process and product of planning designing and constructing space reflects functional, social and aesthetic considerations. It requires the manipulation and coordination of material. Technology, light and shadow.Architecture also encompassed the pragmatic aspects of realizing designed spaces, such as project planning, cost estimating and construction administration. The column arches and gargoyles of classical architecture were dubbed unnecessary. Buildings that flaunted their construction exposing steel beams and concrete surfaces instead of hiding them behind traditional forms were beams and concrete surfaces instead of hiding them behind traditional forms were seen as beautiful in their own right. Architecture first evolved out of the dynamics between needs (shelter, security, worship etc.,) and means (available building material and attendant skills). As human culture evolved and knowledge began to be formalized through oral tradition and practices, architectures became a craft.

   i. 2D (Using AutoCAD): AutoCAD is mainly a computer aided drafting software which is used mainly by the drafters engineers surveyors to create the design of buildings, bridges etc. it has many benefits like shorter time span in preparation of drawings, reduces manpower, very much efficient in drafting etc. It has many advantages over manual methods as if it is faster as it takes very less time. Repetition of work is not there as one can start from where one had left, as it is stored in the computer memory. The previous drawings can be combined to make the newer drawings. It increases the accuracy of the work. Once the drawing is drawn on a screen, it can be easily drawn on paper with a plotter and this will result in neat, clean and accurate drawings with sharp and consistent lettering. It is very economical and affordable to drafting design officer.

   ii. 3D (Rendered Models using Autodesk Revit): Revit is a building information modeling software used across many professions, including architects, structural engineers, designers, and contractors. As an Autodesk product, Revit makes working with important AutoCAD drawings simple and easy. You can model architectural and structure components in 3D for building designs, create 2D floor plans and blueprints, model internal components in 3D, annotate designs for planning purposes, and much more. Because Revit lets you work in 3D, it's easier for the client and builder to visualize the completed project. You can quickly create photorealistic renderings of your designs, perform digital walkthroughs, and provide rich presentation materials. This enables your team to correct any mistakes and update your model before construction begins. These functionalities reduce the risk of error or oversight, and you can quickly learn these key concepts by watching Revit training videos

   iii. 3D (Rendered Models using Autodesk SKETCHUP): SKETCHUP is a computer graphics program for creating 3D models, animations, and digital images. It's one of the most popular programs in the computer graphics industry and is well known for having a robust toolset for 3D artists. A favorite among game developers, TV commercial studios, and

architects, SKETCHUP is owned by Autodesk, the same company responsible for programs like Maya and AutoCAD. 3ds Max is often used for character modeling and animation as well as for rendering photorealistic images of buildings and other objects. When it comes to modeling SKETCHUP is unmatched in speed and simplicity. The software can handle several stages of the animation pipeline including pre-visualization, layout, cameras, modeling, texturing, rigging, animation, VFX, lighting, and rendering.

3. **Structural Analysis and Design by Using STADD PRO:** This chapter reviews about some of the fundamental concepts of structural design and present them in a manner relevant to the design of light frame residential structures. The concepts from the basis for understanding the design procedures and overall design approach addressed in the remaining chapter of the guide. With this conceptual background, it is hoped that the designer will gain a greater appreciation for creative and efficient design of home, particularly the many assumptions that must be made. The world is leading Structural Analysis and Design package for Structural Engineers.

Structural Analysis andDesign: STAAD-III, the world's most powerful and popular structural analysis and design software is in use across the globe since 1980. Now it is available in the form of STAAD Pro which consists of STAAD + STARDYNE +FEM kit + Visual Draw STAAD Pro is a comprehensive, general purpose software for integrated structural analysis and design. STAAD Pro may be utilized for analyzing and designing practically all types of structures - buildings, bridges, towers, transportation, industrial and utility structures. STAAD Pro implements the most modern technologies in today's Computer-Aided Engineering. It unifies leading-edge graphics and visualization techniques with proven and time tested analysis and design. A live, unified database provides seamless integration across all mission critical application from concept design/analysis to detail design, simulation and visualization.

V. CONCLUSION

This is turn facilities the implementations of more effective and professional engineering software. As the application adventure in functionality, one can hope that they will be more affordable to promote their widespread usage amongst civil engineering at global scale. Taking into account the technological advance, this project has been deal with using the latest design software.

VI. ACKNOWLEDGMENT

We are highly grateful to thank ourguide Prof. PoojaKolla (Assistant Professor), Department of Civil Engineering, DYPCOEAkurdi, Pune for the constant intellectual support in the form of innovative ideas and valuable guidance. The expert suggestions and scholarly feedback had greatly enhanced the effectiveness of this work.

REFERENCES

[1] Nasreen M. Khan *et al.'Analysis and Design of Apartment Building'*, International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 3, March 2016.

[2] Shaikh Ibrahim*et al.'Design and Analysis of Residential Building'*, - International Research Journal of Engineering and Technology (IRJET).

[3] Rob Stokes*et al.'Apartment Design Guide'*, NSW Department of Planning and Environment July 2015.