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MODELING AND ANSALYSIS OF G+6 RESIDENTIAL BUILDING USING REVIT ARCHITECTURE AND STAAD. Pro"

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Abstract: In general the construction industry has changed rapidly due to the upcoming needs of people for housing, corporate needs. So, there is great need for the construction of building especially for the housing facilities. By taking into consideration of all the aspects in the building construction including design and analysis as these are considered to be the most important elements in the construction of a structure. The design process of structural planning and design requires not only imagination and conceptual thinking but also sound knowledge of science of structural engineering besides the knowledge of practical aspects, such as recent design codes, bye laws, backed up by example experience, intuition and judgment. Our main idea is to construct a G+6 residential building with good appearance by using best material available in the market with a view of completing the project at low cost by conducting the analysis study using the IS CODE BOOK using AUTOCAD, STAAD.pro Software. This paper gives information about static analysis of G+6 residential building which deals with lateral static forces at beam and column joint and their displacements. The building is designed as three dimensional vertical frames and analyzed for the maximum and minimum bending moments and shearforces.

***Index Terms* –External wall, Internal Wall, Live load, UDL**

I. INTRODUCTION

In every aspect of human civilization, we needed structures to live. The structures should be built in an efficient manner so that it can serve people and save money. In simple words, the building means an empty surrounded by walls and roofs, in order to give shelter for human beings. In early times humans have lived in caves to protect themselves from wild animals, rain etc. Then, humans developed and built their homes using timbers and lived. Nowadays the recent homes are developed into individual and multi-storey buildings. Buildings are the necessary indicator of social progress of the county. At current situation, many new techniques have been developed for constructions. So, that the buildings are built economically and quickly to fulfils the needs of the people. A building frame is a three-dimensional structure which consists of column, beams and slabs. Because of growing population, high rise buildings are coming into demand. Buildings constitute a part of the definition of civilizations, a way of life advanced by the people. The buildings should be constructed for human requirements and not for earning money. Buildings are built in different sizes, shapes and functions. structure, as it relates to civil engineering, is a system of interconnected members used to support external loads. Structural analysis is the prediction of the response of structures to specified arbitrary external loads. During the preliminary structural design stage, a structure's potential external load is estimated, and the size of the structure's interconnected members are determined based on the estimated loads. Structural analysis establishes the relationship between a structural member's expected external load and the structure's corresponding developed internal stresses and displacements that occur within the member when in service. This is necessary to ensure that the structural members satisfy the safety and the serviceability requirements of the local building code and specifications of the area where the structure is located.

Different types of loads acting on the structure:

1. Dead load
2. Live load
3. Wind load
4. Seismic load
5. Snow load

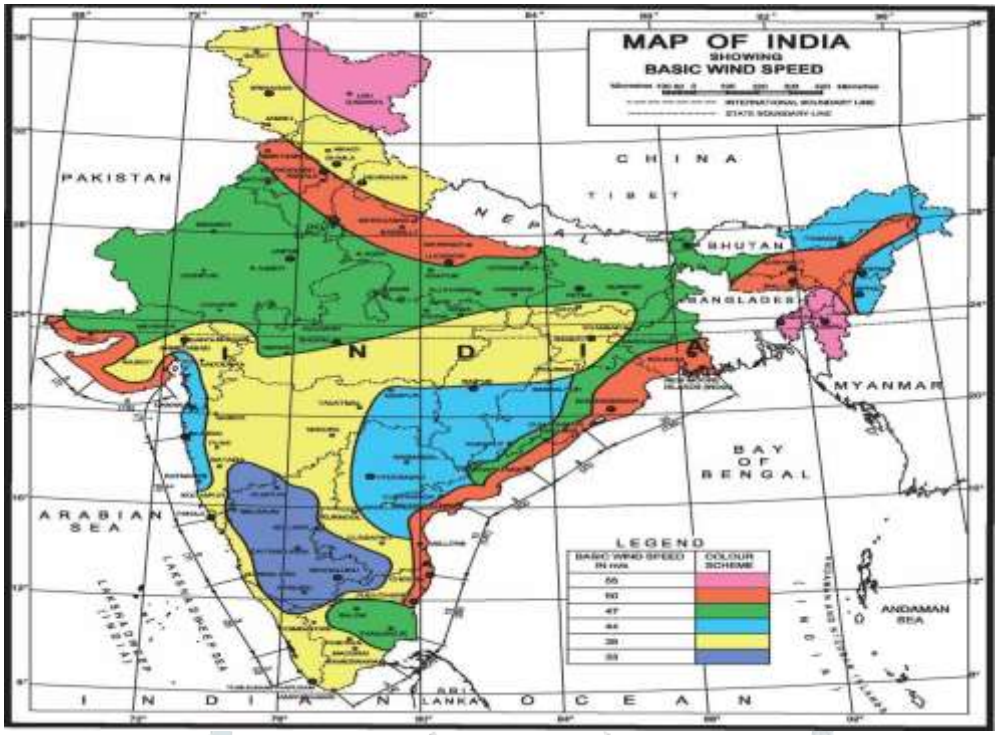

Fig-1.0: Zones for wind load

Wind loads can be applied by the movement of air relative to a structure, and analysis draws upon an understanding of meteorology and aerodynamics as well as structures. Wind load may not be a significant concern for small, massive, low-level buildings, but it gains importance with height, the use of lighter materials and the use of shapes that may affect the flow of air, typically roof forms. Where the dead weight of a structure is insufficient to resist wind loads, additional structure and fixings may be required. Wind load is required to be considered in structural design especially when the heath of the building exceeds two times the dimensions transverse to the exposed wind surface.

The design wind loads for buildings and other structures shall be determined according to one of thefollowing procedures:

Method 1 – Simplified procedure for low-rise simple diaphragm buildings

Method 2 – Analytical procedure for regular shaped building and structures

Method 3 – Wind tunnel procedure for geometrically complex buildings and structures

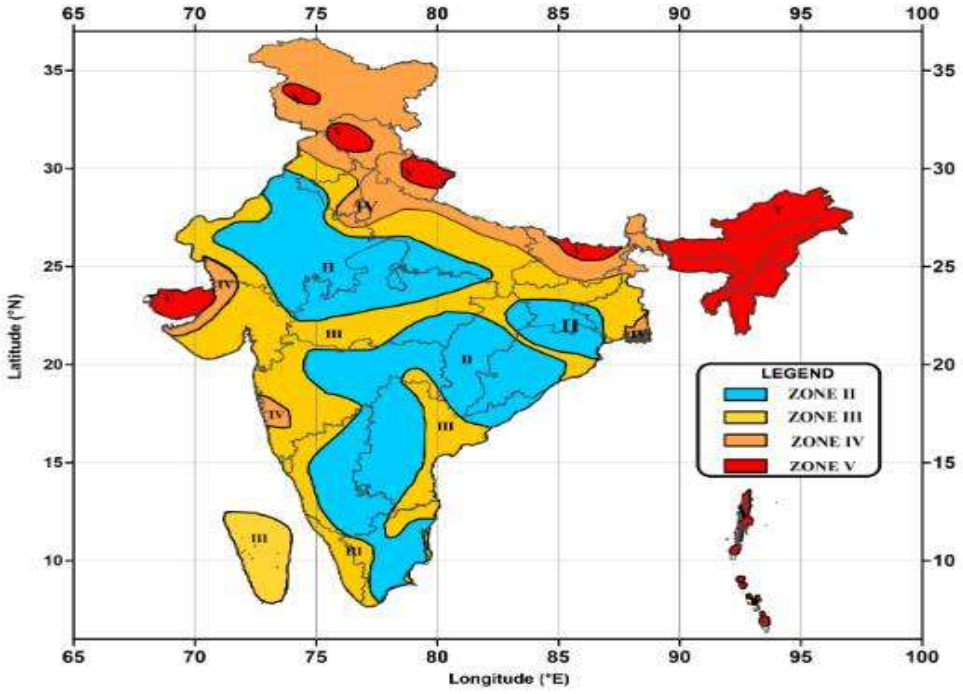

Fig-2.0: Seismic zones

OBJECTIVES OF THE STUDY:

- To plan the building with required comforts and INDIAN STANDARD recommendations.
- To determine the shear forces and lateral force acting at each floor of the structure at considerable frame under wind load.
- To carry out a comparative study between the lateral forces as well as shear forces obtained by load combinations using load analysis and software analysis.
- To show the realistic view of the desirable structure using REVIT architecture.

2.0 LITERATURE REVIEW:

- **Safwanahmad et.al (2017), have designed a G+2 hospital building using STAAD. Pro** by applying suitable loads and sectional details to component within the main aim of this factor was to study the extent of credibility of using STAAD. Pro for analysis.
- **Adiyanto (2008), Analyzed a 3-storey hospital building using STAAD Pro**. Seismic loads were applied to the building. The dead loads and live loads were taken from BS6399:1997 and seismic loads intensity is based on equivalent static force procedure in UBC1994. Result showed that the building can withstand any intensity of earthquake. It means that the buildings were suitable to be built in any area located near the epicenter of the earthquake.
- **Ibrahim, et.al (April 2019), analyzing the G+4 story residential building structure**, conducted that the structure is rate in loading like dead load, live load, wind load and seismic loads. Member dimensions (Beam, column and slab) are assigned by calculating the load type and its quantity applied on it. Auto CAD gives detailed information at the structure member's length, height, depth, size and numbers, etc. STADD Pro. has a capability to calculate the program contains number of parameters which are designed as per IS 456: 2000. Beams were designed for flexure, shear and tension and it gives the detail number, position and pacing brief.
- **B. Gireesh studied the structural and seismic analysis of G+ 7 structures using the Stadd.Pro software**. In this study the design was based on the following Indian standard codes: IS 1893 (Part 1) – 2007, for the design of base shear. IS 1893:2002 for the earthquake resistant criteria which stated the different analysis criteria based on Zone of area, the height of building and Importance of the building. After starting the project various dead load, live load, wind load, snow load and earthquake load was imposed for which the analysis will run. The building was designed for Hyderabad area whose zone was II. From the analysis, it was concluded that the steel quantity was increased by 1.517% compared to the conventional concrete design. The earthquake load was more dominant than wind load in the selected area but still, there was no need for a shear wall and braced column as the base drift at every storey is 0.0 hence the structure was safe under the drift condition.
- **Alkesh Bhalerao et.al (2016), Studied the effects of wind on different structural orientation of RCC buildings**. The study aims at identifying an optimum structural shape of building which could withstand the wind forces under consideration. The building was a G+25 structure analyzed for structural stability using ETABS software. U-shape structure is not preferred as it gives the maximum displacement and maximum drift due to its geometric shape most susceptible for wind load. Bundled tube symmetric RCC structure is need to analyzed for special provision and improved cladding surface to attain optimized
result.
- **D. Ramya et.al, (2015), compared the design and analysis over a multi- storeyG+10 building with STAAD. Pro** an ETABS software. The basic wind speed for this study was taken as 33.0 m/s and the shear force and bending moment over each of the component of the building was calculated for different combination of loads. This study shows that STAAD. Pro is more flexible when compared to ETABS software in terms of analysis of structure.
- **Madhurivassavai et al., (2016),** have stated that most common problem country facing is the growing population. Because of the less availability of land, multi- storey building can be constructed to serve many people in limited area. Efficient modeling is performed using STAAD. Pro and AutoCAD. Manual International Journal of Pure and Applied Mathematics Special Issue 2798 calculations for more than four floor buildings are tedious and time consuming. STAAD. Pro provides us a quick, efficient and correct platform for analyzing and coming up with structures.
- **Devi Krishna Chaitanya (2017)** has said that in order to compete in the ever- growing competent market it is very important for a structural engineer to save lots of time. For this an attempt is made to model and survey the construction using software. For analyzing the structure all possible loads are considered to see whether the structure is safe against loading. There are many strategies for analysis of various frames like kani's methodology, cantilever methodology, portal methodology and Matrix methodology. The dead load &live loads are applied. Then, the design for beams, columns, footings are done. STAAD. Pro is a very powerful toll which can save time.
- **SK Saleem (2017**) has explained that the objective of the project is to detect and scan a multi-storey building. Load calculations are done manually and STAAD. Pro software is used for analyzing the structure. STAAD. Pro is the recommended software. STAAD. Pro is user friendly software which allows the users to make the mount and the load values to be given and dimensions. Then the work is continued for 2-D and 3-D frames with different loading conditions.
- **Anoop. A, (2016),** explained that the scope of the project is to provide a multi storied building of G+ 5 floors. Rivet 2011 and Auto CAD 2014 software is used for developing 3-D models. The structure analysis and design are done using STAAD. Pro. The results are checked for selected members using limit state method of design as per IS 456-2000.

BUILDING DETAILS AND SPECIFICATIONS:

- Size of the building – 30 X 22 m.
- Set backs of the building – 8 m.
- Plot Size - 660 Sq.m.

- Height of each floor - 3m.
- Grade of concrete - M25
- Grade of steel - Fe500
- Plinth height above the ground level - 0.9 m.
- Depth of the foundation – 2.3 m.
- External Wall thickness - 0.23 m.
- Internal Wall thickness - 0.115 m
- Wind Intensity – 45 m/s
- Wind Category - Category III
- Size of the column – 0.38 X 0.23m.
- Size of the beam – 0.3 X 0.23m.
- Fc – 25 KN/Sq.m.
- Fy main – 500 N/mm^2.
- Fy sec – 500 N/mm^2.
- Max main – 16 mm.
- Max sec – 12 mm.

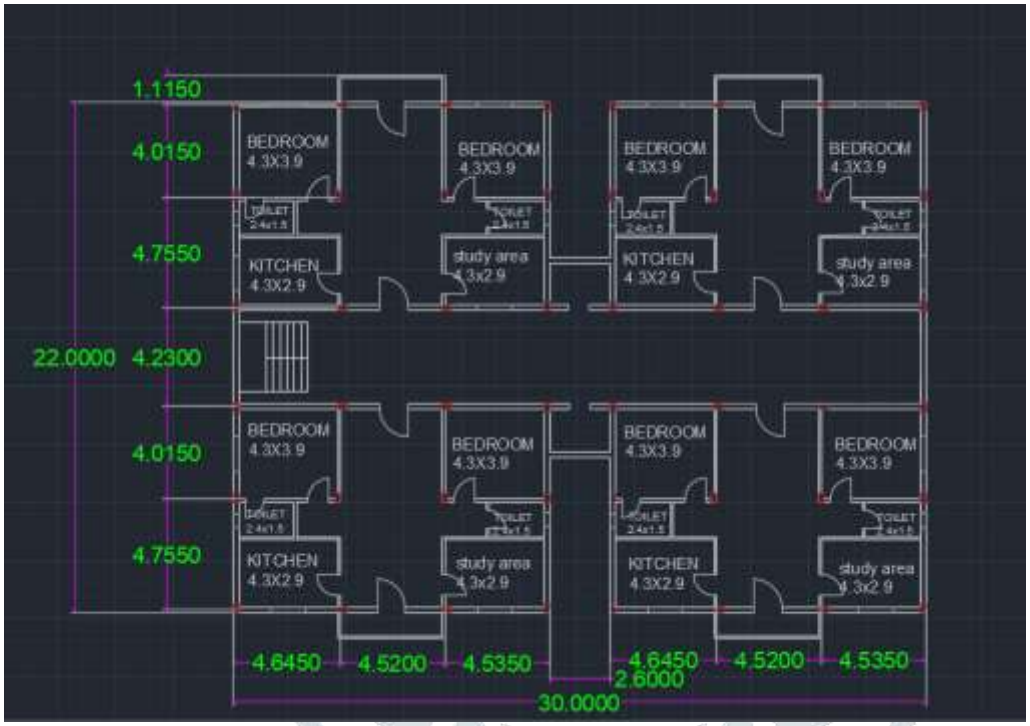

Fig-3.0: Plan Of The Building

MODELING AND RESULTS:

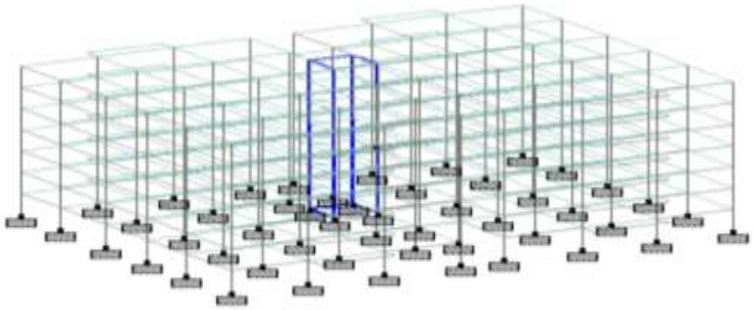

Fig -4: Skeletal Structure

REINFORCEMENT DETAILS OF STRUCTURAL MEMBERS:

Fig-5: Reinforcement details of beam

Fig-6: Reinforcement details of column

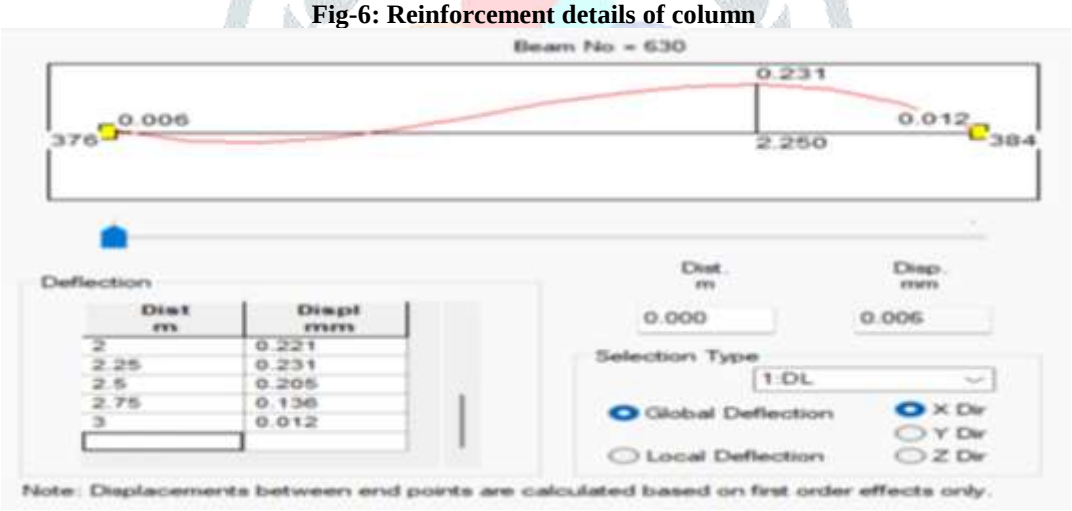

Fig-7.0: Column Deflection

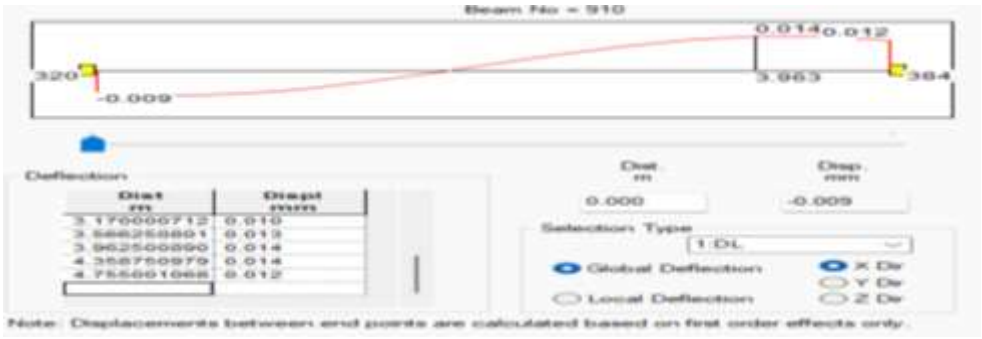

Fig-8.0: Beam Deflection

CONCLUSIONS:

- Planning, analysis and design of G+6 multi-storey residential building was done. It's a G+6 storied building with parking in the basement and the rest of the floors are occupied with apartments. All the structural components were

designed manually and detailed using AutoCAD.

- The analysis and design were done according to standard 8 specifications using STAAD. Pro for static and dynamic loads.
- The dimensions of structural members are specified and the loads such as dead load, live load, floor load and earthquake load are applied.
- Deflection and shear tests are checked for beams, columns and slabs. The tests proved to be safe. Theoretical work has been done. Hence, I conclude that we can gain more knowledge in practical work when compared to theoretical work.

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