Analysis, Design, Modeling and Rendering of G+5 Residential Building by Using Staad. Pro, Sketchup and V-Ray

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A B S T R A C T

Because the following level involves using the software programmes STAAD Pro, Sketchup, and V-Ray to analyse and design a multi-story structure, a structural engineer must work faster in order to compete in the always growing competent market. When analysing a multi-story building, all potential loads must be taken into account, and the structure must be secure in all scenarios. The Kanis method, the Cantilever approach, the Portal method, and the Matrix method are techniques for analysing various frames. A G+5 multi-story residential building with three homes on each floor is the subject of the current project. Dead and traffic loads are applied, and beams, columns, and foundations are designed. Because to its new features, STAAD Professional outperformed its predecessor in terms of data transfer capabilities with other significant programmes like Auto CAD. The STAAD PRO computer-based design of residential structures includes the creation of construction plans, the acquisition of models, structural analysis, and structural design. We come to the conclusion that STAAD.Pro is a very potent tool that can produce highly accurate models while saving a significant amount of time. A BIM tool or software is Sketch Up (formerly known as Google Sketch Up). Like other pricey BIM programmes, SketchUp Basic is free, easy to use, and applicable to several industries at once.

Keywords: - staad pro, sketchp and v-ray

1. Introduction

The area of engineering that deals with building structures like houses is known as structural engineering. A simple structure can be used to describe an area surrounded by walls, a roof, supplies for food and clothing, and other necessities for people. In order to avoid being harmed by wild animals, rain, or sunlight, people used to dwell in caves, above trees, or beneath trees. As time went on, people started to dwell in huts built of wood branches. The old lodgings have since been transformed into stunning residences. Wealthy folks reside in opulent residences. Buildings are a crucial gauge of a nation's socioeconomic development. Everyone wants to live in a cosy house because, on average, individuals spend two thirds of their life there. the protection provided by civic duty. These are the key factors that drive people to spend their hard-earned money on property ownership. Today, building new homes is crucial to the county's socioeconomic development. New methods for building houses that are rapid, inexpensive, and fulfil community needs are developed every day. Buildings are planned and designed by engineers and architects. The management of engineers and architects, as well as the drawing work for the building, is done by draughtsmen. Drawing the essential building drawings, site plans, and layout plans, among other things, requires the draughtsman to be knowledgeable in his specialty, follow the engineer's directions, and be competent to draw.

Software for structural analysis and design was used to produce the design (staad-pro). There were both vertical and horizontal loads placed on the structure. The dead and live loads from structural elements like beams, columns, and slabs make up the vertical load. The building is designed for dead load, live load, and wind load because, in accordance with IS 875, the horizontal load comprises of wind forces.

2. Literature Review

The numerous factors to consider while choosing software for building analysis and design are covered in this chapter. Further details about the codes are provided in this chapter.

1987 IS: 875 (Part 1) Design loads for dead loads are according to Indian Standard Code of Practice (Other Than Earthquake) For buildings and other structures, all of the structure's permanent constructions combine to generate the dead loads. The dead load is made up of the weights of permanent constructions such as walls, partitions, floor finishes, artificial ceilings, false floors, and other structures in buildings.

IS: 875 (Part 2) – 1987 Indian Standard Code Of Practice For Design Loads (Other Than Earthquake), For Buildings And Structures, 1987 The weight of movable partitions, distributed and concentrated loads, load due to impact and vibration, and dust loads are all examples of imposed loads produced by the intended use or occupancy of a building. Loads imposed by wind, seismic activity, snow, and temperature changes to which the structure will be subjected, creep and shrinkage of the structure, and differential settlements to which the structure may be subjected are not included in the imposed loads.

IS: 875 (Part 3) – 1987 in the case of wind loads, Indian Standard Code of Practice For Design Loads (Except Earthquake) For Buildings And Structures, This standard specifies wind forces and their effects (static and dynamic) when designing buildings, structures, and their components. Wind is defined as air moving relative to the earth's surface. Wind is caused primarily by the rotation of the Earth and differences in terrestrial radiation. The radiation effects are primarily responsible for either upward or downward convection. At high wind speeds, the wind usually blows horizontally to the ground. Because the vertical components of atmospheric motion are so small, the term "wind" almost always refers to the horizontal wind; vertical winds are always identified.

3. Methodology

3.1 SALIENT FEATURES OF BUILDING PROPERTIES

• Building utility: residential complex

• Number of stories: G+5

• Building Dimensions: 5 FLOORS

• Number of staircases: 1

• Number of flats per floor: 3

• Number of lifts: 1

• Type of construction: R.C.C. framed structure

3.2 GEOMETRIC DETAILS

• Ground floor: 4m

• Floor to Floor height: 3m

• Plinth height: 1.5m

• Foundation depth: 500m

3.3 MATERIALS

All steel grades: Fe550grade

Concrete Grade: M25

3.4 DESIGN OF STRUCTURAL ELEMENTS

The design of any structure is characterized in to the following two main types

Functional design

Structural design

3.4.1 Stages in Structural Design

The following stages are involved in the structural design process:

Structure design

Load calculations

The analysis method

Designing members, detailing them, drawing them, and creating schedules are all part of the job.

3.4.2 SOFTWARE:

This project is heavily reliant on software, so it is critical to understand the specifics of these programmes.

List of software applications:

STAAD pro:

Staad is a robust drafting programme licenced from Bentley. Staad is an abbreviation for structural analysis and design. A structure is any object that is stable under a certain load. So, first, find the structure's outline, where the analysis is the estimation of the nature of the loads acting on the beam and the calculation of the shear force and bending moment. The type of materials and their dimensions are designed to withstand the load during the design stage.

This is done after the analysis. Calculating the s.f.d. and b.m.d. of a complex loading bar takes about an hour. So, if it comes in with multiple members, it will take a week. Staad Pro is an extremely powerful tool that can complete this task in under an hour. For high-rise buildings, Staad is the best option. Most high-rise buildings are now designed by Staad, which necessitates the knowledge of software by a civil engineer. This software can be used to transport rec steel, bridges, trusses, and other materials based on country codes.

PLAN:

DESIGN AND ANALYSIS OF G+5 BUIDING USING STAAD PRO :-

Generation of nodes

Modelling of the structure

Restraints

Assigning of structural members

Application of loads

Run Analysis.

Generation of node:-

The nodes are generated based on the building's dimensions. The structure is divided into an equal number of well-known grids. The grid spacing is then shown on the STAAD Pro window. The software generates a grid with a specific window automatically.
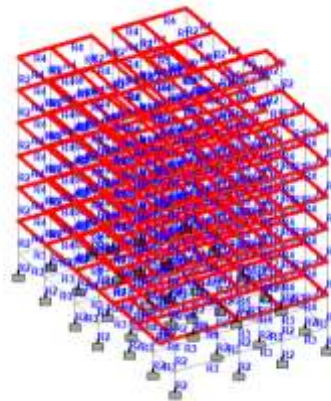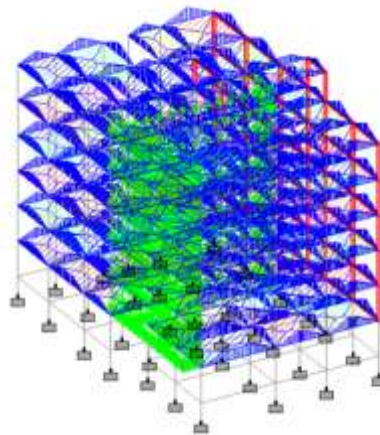
ISOMETRIC VIEW OF FLOOR PLAN
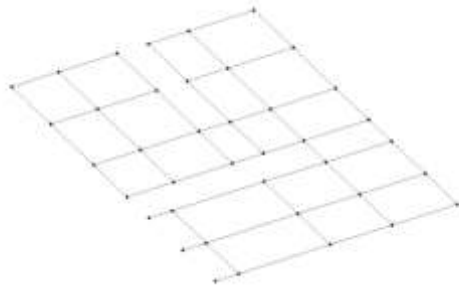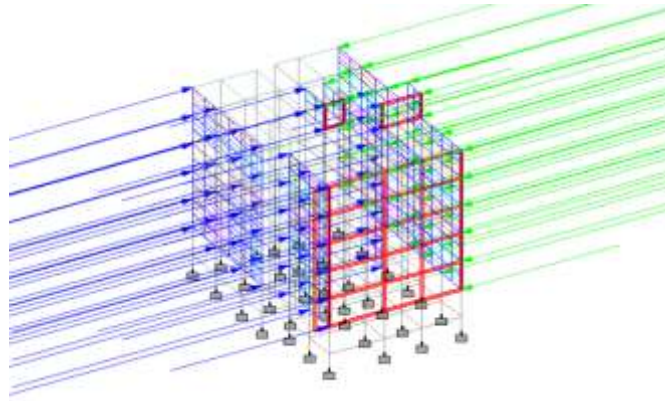
PROPERTIES OF THE STRUCTURE

ASSIGINING OF PLATE THICKNESS

LIVE LOAD ON STRUCTURE

WIND LOAD ON X AXIS

WIND LOAD Z-AXIS
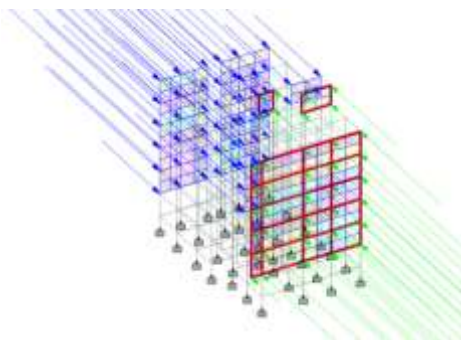
DEAD LOAD ON STRUCTURE
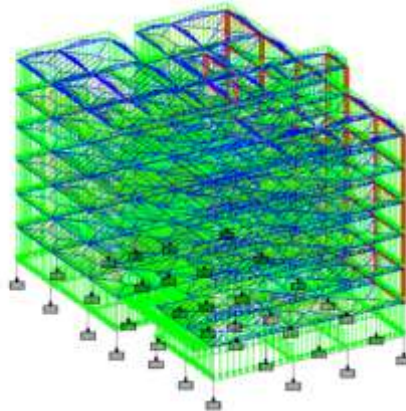
DESIGN OF BEAMS
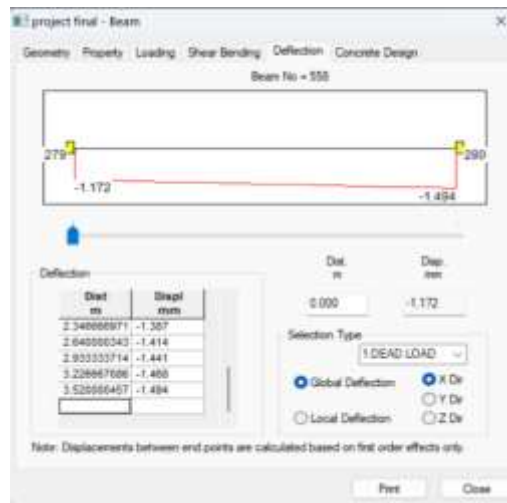
DEFLECTION

SKETCHUP FLOOR PLAN

ENTRANCE OF BUILDING

V-RAY FRONT VIEW

REALISTIC VIEW FROM V-RAY

CONCLUSIONS :

1. The building's structural elements are safe in flexure and shear.

2. The amount of steel provided for the building is both economical and sufficient.

3. The plan is designed in such a way that the house is well ventilated.

4. It was discovered that the structure is safe in loading such as dead load, live load, and wind load after analysing the G+5 STAAD PRO gives the detail number, position, and spacing of reinforcement of a columns and beams storey building structure.

5. Ray traced photorealistic rendering

6. Sketchup uses parametric views, which means that a single change in one view automatically updates all views.

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