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DESIGN OF STRUCTURE SUPPORTED ON SINGLE COLUMN

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ABSTRACT:

The progress of building technology and the proliferation of high-height commercial structures are driven by the fast increase in population and the shortage of land. Improving the different activities relies heavily on building. People in the modern world are driven to travel long distances, mostly in search of better economic opportunities. Additional services, such as a finance, computer, administrative, design, and drawing division, are available in the facility. The stability of structural components during their lifespan is determined by their supporting state. When all stability conditions are met, we say that the structure is stable. A structure's stability is enhanced when all of its sides provide support in a proportionate manner that balances the static and dynamic stresses. In order to make our building seem nice, we just used one column for support. The configuration of a structure determines how difficult it is to meet the stability requirements; when subjected to symmetrical and eccentric loading conditions, a single-column structure is particularly vulnerable. In extreme cases, eccentric stress may lead to structural collapse by twisting the material in any direction. Every other component will function as a cantilever since a single column is supporting the whole construction. By using two ring beams and inclined beams, the structural beams' cantilever span may be reduced, allowing them to be simply supported for two-thirds of their length. The structural analysis programme Staad pro, which uses the stiffness matrix approach for analysis and design, is used. For design purposes, the critical loading condition was chosen after analysing the aforementioned structure for all potential loading circumstances.

Keywords: Single column, symmetrical, eccentric loads, Staad Pro.

1. INTRODUCTION:

Various components, as well as the project's planning, structural analysis, design, and

drawings, as well as an estimate of the total cost, are included in this document. Hyderabad is where the planned location is situated. Inside this structure you will find... The single column is a

kind of mono column construction that supports the whole block with a single rectangular column in the middle. There is one column that extends up four stories beyond the basement. You can travel horizontally and vertically between levels using it. The building has a dog-legged staircase, an elevator, a dining room, a bathroom, a porch and a toilet. For a single column, the recommended concrete grade is M30. Each column is reinforced with high-strength deformed bars. Each structural part complies with IS: 456– 2000 in terms of design. Assuring the structure will function adequately over its design life is the fundamental goal of structural design. More specifically, the designer has to make sure the structure can safely support the loads and won't bend or break too much because of them. To do this, the designer must take into account the potential loads on the structure and the strengths of the materials used to construct it. In addition, the designer should be familiar with the fundamentals of structural behaviour. Two goals will be pursued in the following work:

1. to explain the theory of building design;

Secondly, to provide a foundational understanding of how structures and materials behave. The term "design" may imply several things to many individuals. A conceptual plan, first drawing, pattern, building, plot, or creation is what

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the term is defined as in dictionaries. People who work directly with the built environment still disagree on a lot of things. For architects, for instance, design could include creating visual representations of a new structure via the use of models and drawings. Design, on the other hand, encompasses all stages of planning for a new building, bridge, tunnel, road, etc., from conceptualization and feasibility studies to mathematical calculations and working drawings that could reveal every component in the project. This is according to civil and structural engineers. Bills of quantities, specifications, contracts, and engineering and architectural drawings will all come together to provide the legal and organisational framework that a contractor working under the supervision of those professionals may use to build the project.

OBJECTIVE OF THE STUDY:

1. To design and analysis of mono column building by using Staad. Pro software to with stands the gravity loads.
2. Analysis using Staad pro on of mono column building.
3. Design using Staad. Pro on of mono column building.

2. LITERATURE SURVEY:

Chen and Constantinou (1998) research revealed that the practical method explains how sloping ground storeys of buildings are intentionally made more flexible. To support part of the superstructure, the system employs Teflon sliders. The ground-level ductile columns and Teflon sliders are responsible for dissipating energy. Using this idea, we examine and talk about the features of a multi-story frame's seismic reaction. The findings prove that the ground floor may be securely supplied to without jeopardising the superstructure.

Chandrasekaran and Rao (2002) investigated analysis and the design of multi-storied RCC buildings for seismicity. Reinforced concrete multi-storied buildings are very complex to model as structural systems for analysis. Usually, they are modeled as two-dimensional or three-dimensional frame, systems are in to plane and slope with different angles 5°, 10°, and 15°. Analyze multistoried buildings in the country for seismic forces and comparing the axial force, shear force, moment, nodal displacement, stress in beam and support reaction compared to current version of the IS: 1893 – 2002 to the last version IS: 1893-1984.

Birajdar B.G. (2004) showcased the findings from seismic assessments conducted on twenty-four RC structures with three distinct configurations, namely, step-back building, step-

back set-back building, and set-back building. The response spectrum approach was used to do a three-dimensional study that takes tensional effects into account. In order to determine whether a building layout is appropriate for sloped land, researchers have examined the dynamic response qualities, such as the fundamental time period, to p-storey displacement and the base shear action caused in columns. Buildings with a step-back or set-back orientation seem to work better on sloped terrain.

3. MATERIALS AND METHODOLOGY

The term "structure" refers to an assembled set of parts. STAAD can study and create structures using solid, plate/shell, and frame components. When it comes to structures, STAAD can handle just about everything. The most basic kind is a SPACE structure, which consists of a three-dimensional frame that can support loads in any direction. Loads acting on the same plane define a plane structure, which is bounded by a global X-Y coordinate system. The members of a TRUSS construction are designed to withstand axial forces alone and are not capable of bending. When all horizontal (global X or Z) movement of the structure is prevented at every joint, we say that a two- or three-dimensional structure is a floor structure. A building's floor framing is a perfect illustration of a floor structure in the global X-Z plane. In the absence of horizontal stress, columns

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will resist no moments. A fixed support has restraints against all directions of movement.

may be represented in FLOOR structures together with the floor. A SPACE analysis is required in the presence of any horizontal stress.

GENERATION OF THE STRUCTURE

The structure may be generated from the input file or mentioning the co-ordinates in the GUI. The figure below shows the GUI generation method.

MATERIAL CONSTANT

You may find these material constants written as E, DEN, POISS, ALPHA, BATA, or coordinates for every reference point (REF) as well as the modulus of elasticity (E), weight density (DEN), composite damping ratio, and beta angle (BATA). We will not do the analysis until you supply the E value for the members. When considering the structure's own weight, weight density is the sole metric to utilise. The shear modulus, abbreviated as G, may be determined using Poisson's ratio and the following formula.

$$G = 0.5 \times E / (1 + \text{POISS})$$

SUPPORT

Supports are specified as PINNED, FIXED or FIXED with different releases (known as FIXED BUT). A pinned support has restraints against all translational movement and none against rotational movement. In other words a pinned support will have reaction for all forces but

LOADS

Loads in the structure can be specified as joints loads, member load, temperature load and fixed end member load. STAAD can also generate the self-weight of the structure and use it as uniformly distributed member load in analysis. Any fraction of this self weight can also be applied in any desired direction.

JOINT LOAD: Joint loads, both forces and moments, may be applied to any free joint of a structure. These loads act in global coordinate system of the structure. Positive force act in the positive coordinate directions. Any number of loads may be applied on single joint, in which case the loads will be additive on that joint.

Member load: Direct application of one of three member loads is possible to every structural member. The three types of loads include those with a uniform distribution, those with a concentration, and those with linear variations, including trapezoidal. Any portion of a member's length may be subjected to uniform loads. Any intermediate, designated site may operate as a concentrated load. Loads that fluctuate linearly have an effect on a member along its whole length. Over a member's whole or partial length,

trapezoidal linearly changing loads exert their force.

Area/floor load: A evenly distributed load is applied to a floor that is constrained by the X-Z plane. Finding out how many people are on that floor might be a huge undertaking. You may define the area loads (unit load per unit square area) for members using the AREA or FLOOR LOAD commands, however. In order to determine the correct member loads, the programme will determine the tributary area for each member. When the distribution is one way, the Area Load is utilised, and when it is two ways, the Floor Load is used.

Fixed end member load: Load effects on a member may also be specified in fixed end loads. These loads are given in the terms of its are given in terms of the member coordinate system and the directions are opposite to the actual load on the member. Each end of a member can have six forces: axial, shear y, shear z, torsion, moment y, and moment z.

Moving Load Generator: This feature enables the user to generate moving loads on members of a structure. Moving load system(s) consisting of concentrated loads at fixed specified distance in both directions on a plane can be defined by the user. A user specified number of primary load cases will be subsequently generated by the program and taken into consideration analysis.

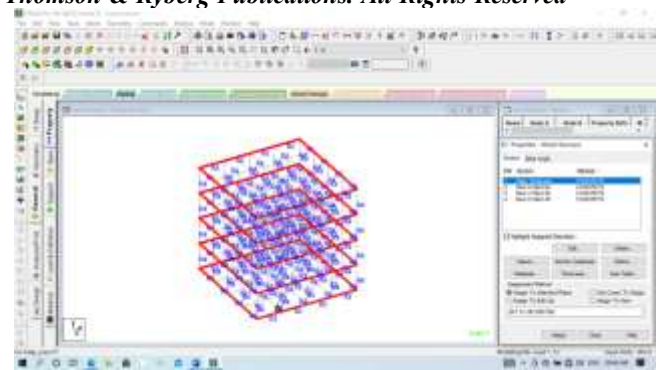


Fig.3.1. Slab thickness assign.

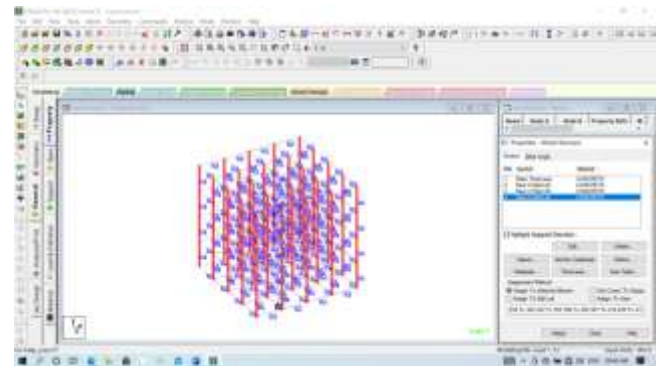


Fig.3.2. Column property assign.

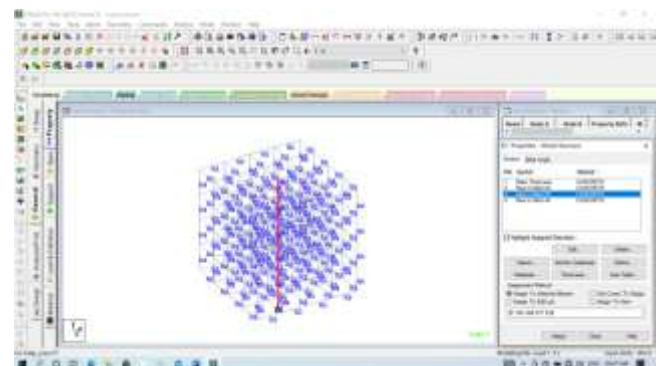


Fig.3.3. Mono column assign.

Fig.3.6. Stadd output quantities.

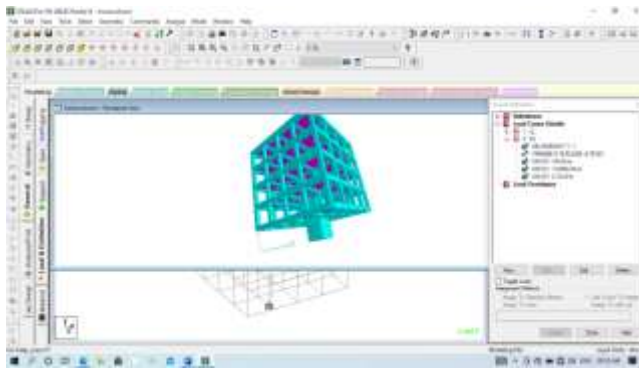


Fig.3.4. 3d view.

The live load considered in each floor & terrace was 3 KN/sq m. The live loads were generated in similar manners as done in the earlier case dead load in floor. This may be done from the member load button from the load case column.

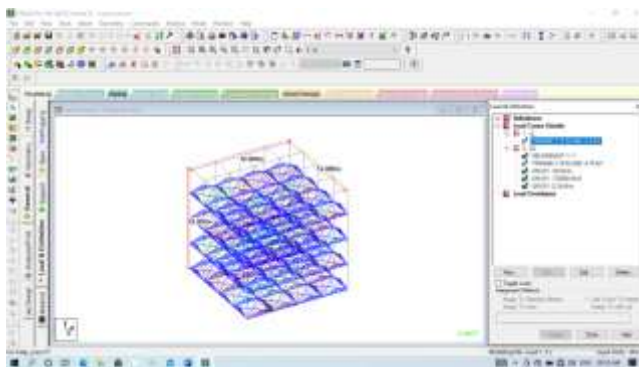


Fig.3.5. The structure under live load.



CONCLUSION

We choose this project with all our heart and did our best to make sure it was done well, and now we can look back with pleasure. Careful analysis and design went into the completion of the Building with Mono Column (single supported building) project. During the planning and design process, we made care to maximise space utilisation. We guarantee that it will be really useful.

FUTURE SCOPE

1. This present study considered to only LIVE LOAD & DEAD LOAD. The same may be extended to wind & seismic analysis.
2. This analysis is done for 2D frame structures. This may extended to 3D-structures.

The performance will be calculated by taking the parameters like precision, accuracy, and time.

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