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DESIGN OF STRUCTURE SUPPORTED ON SINGLE COLUMN

[1] K. Sivakarthik, [2] M. Ramesh Babu

[1] Assistant Professor, Department of CIVIL Engineering, AM Reddy Memorial College Of Engineering and Technology, Andhra Pradesh 522601

[2]Assistant Professor, Department of CIVIL Engineering, AM Reddy Memorial College Of Engineering and Technology, Andhra Pradesh 522601

ABSTRACT:

The rapid increase in population and scarcity of land tends to the development of construction technology and high rise commercial structures. Building plays a vital role for improving the various activities. In the late world, prompt to action of peoples from one place to another is of great extent mainly for earnings. In building more facilities like financing section, computer section, administration section, design section and drawing section are provided. The supporting condition of structural members determines their stability during their lifetime. A structure is said to be stable when it satisfies all stability requirements. Structures will be more stable when all the sides proportionally to balance the static and dynamic loads support it; the structure has supposed to be supported. For aesthetic appearance we create our building supported by a single column. Satisfying the requirement of stability conditions for a single column structures will be a complicated one, compare with the structures supporting in all the sides depends upon their configuration; single column structure is a critical one when it is being to an symmetrical and eccentric loading condition. Eccentric loading will cause the structure to twist in any direction and may cause failure of structure is very critical condition. Since single column is supporting whole structure, all other members will act as cantilevers. To reduce the cantilever span for the structural beams converting two-third of the length as simply supported by providing the two ring beams and inclined beams. The structure is analyzed and designed using Staad pro (structural analysis package), which is based on stiffness matrix method. The above structure has been analyzed for various possible loading conditions and the critical has been selected for design purpose.

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

1. INTRODUCTION:

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Volume 7, Issue 3, 2019

This project describes planning, structural analysis, design and drawings with various components and approximate cost of the whole building. The proposed site is located at Hyderabad. This building consists. Single column is special mono column structure (the whole block is supported by single rectangular column at the center). Single column 4 floors in addition to the ground floor. It is provided for vertical and horizontal movement between the floors. It consists of staircase (Dog-legged), lift, dining room, rest room, verandah and toilet. Concrete grade used in single column is M30. High strength deformed bars are used for both the single column for reinforcement. Design of all structural members conforms to IS: 456- 2000. The primary aim of all structural design is to ensure that the structure will perform satisfactorily During its design life. Specifically, the designer must check that the structure is capable of carrying the loads safely and that it will not deform excessively due to the applied loads. This requires the designer to make realistic estimates of the strengths of the materials composing the structure and the loading to which it may be subject during its design life. Furthermore, the designer will need a basic understanding of structural behavior.

The work that follows has two objectives:

1. To describe the philosophy of structural design;

2. To introduce various aspects of structural and material behavior.

Design is a word that means different things to different people. In dictionaries the word is described as a mental plan, preliminary sketch, pattern, construction, plot or invention. Even among those closely involved with the built environment there are considerable differences in interpretation. Architects, for example, may interpret design as being the production of drawings and models to show what a new building will actually look like. To civil and structural engineers, however, design is taken to mean the entire planning process for a new building structure, bridge, tunnel, road, etc., from outline concepts and feasibility studies through mathematical calculations to working drawings which could show every last nut and bolt in the project. Together with the drawings there will be bills of quantities, a specification and a contract, which will form the necessary legal and organizational framework within which a contractor, under the supervision of engineers and architects, can construct the scheme.

OBJECTIVE OF THE STUDY:

ISSN 2347–3657
Volume 7, Issue 3, 2019

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) studied that the practical system deliberately introduces flexibility to the sloping ground storey of structures was described. The system utilizes Teflon sliders to carry a portion of the superstructure. Energy dissipation is provided by the ground story ductile column s and by the Teflon sliders. Utilizing this concept the seismic response characteristics of a multistory frame are analyzed a discussed. The results show that it is possible to provide safely to the superstructure while maintaining the stability of the ground storey.

Chandrasekaran and Rao (2002) investigated analysis and the design of multi- storied RCC buildings for seismicity. Reinforced concrete multi-storied buildings re 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 t o current version of th e IS: 1893 – 2002 to the last version IS: 1893-1984.

Birajdar B.G. (2004) presented the results from seismic analyses performed on 24 RC buildings with three different co figurations like, Step back building; Step back Set back building and Set back building are presented. 3 –D analysis including tensional effect has been carried out by using response spectrum method. The dynamic response properties i.e. fundamental time period, to p storey displacement and, the base shear action induced in columns have been studied with reference to the suitability of a building configuration on sloping ground. It is observed that Step back Set back buildings are found to be more suitable on sloping ground.

3. MATERIALS AND METHODOLOGY

A STRUCTURE can be defined as an assemblage of elements. STAAD is capable of analyzing and designing structures consisting of frame, plate/shell and solid elements. Almost any type of structure can be analyzed by STAAD. A SPACE structure, which is a three dimensional framed structure with loads applied in any plane, is the most general. A PLANE structure is bound

ISSN 2347–3657
Volume 7, Issue 3, 2019

by a global X-Y co-ordinate system with loads in the same plane. A TRUSS structure consists of truss members who can have only axial member forces and no bending in the members. A FLOOR structure is a two or three dimensional structure having no horizontal (global X or Z) movement of the structure [FX, FZ & MY are restrained at every joint]. The floor framing (in global X-Z plane) of a building is an ideal example of a FLOOR structure. Columns can also be modelled with the floor in FLOOR structure as long as the structure has no horizontal loading. If there is any horizontal load, it must be analyzed as a SPACE structure.

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

The material constants are modulus of elasticity (E); weight density (DEN); Poisson's ratio (POISS); co-efficient of thermal expansion (ALPHA), composite Damping Ratio, and beta angle (BATA) or coordinates for any reference (REF) point. E value for members must be provided or the analysis will not be performed. Weight density is used only when self weigh of the structure is to be taken into account. Poisson's ratio is used to calculate the shear modulus (commonly known as G) by the formula.

G = 0.5 x E/ (1 + 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 will resist no moments. A fixed support has restraints against all directions of movement.

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

ISSN 2347–3657
Volume 7, Issue 3, 2019

loads may be applied on single joint, in which case the loads will be additive on that joint.

Member load: Three type of member loads many be applied directly to a member of a structure. These loads are uniformly distributed load, concentrated load, and linearly varying loads (including trapezoidal). Uniform loads act on the full or partial length of a member. Concentrated load act at any intermediate, specified point. Linearly varying loads act over the full length of a member. Trapezoidal linearly varying loads act over the full or partial length of a member.

Area/floor load: Many limes a floor(bound by X-Z plane is subjected to a uniformly distributed load. It could require a lot of work to calculate the member load for individual members in that floor. However, with the AREA or FLOOR LOAD command, the user can specify the area loads(unit load per unit square area) for members. The program will calculate the tributary area for these members and provide the proper member loads. The Area Load is used for one way distributions and the Floor Load is used for two way distributions.

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 win be subsequently generated by the program and taken into consideration analysis.

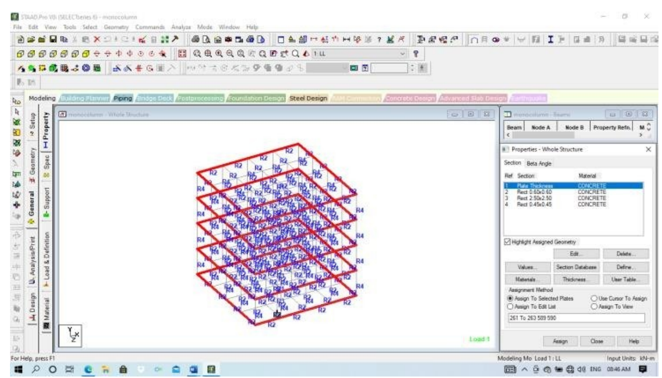

Fig.3.1. Slab thickness assign.

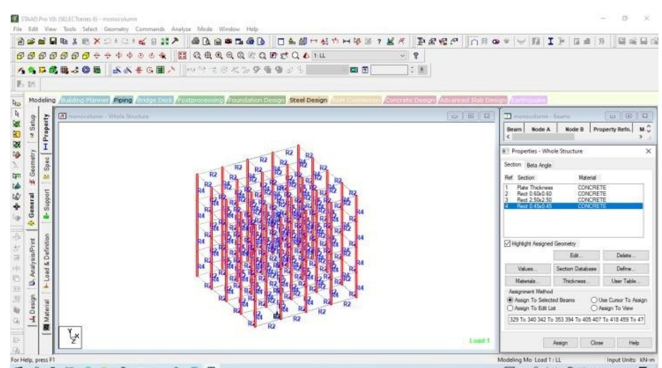

Fig.3.2. Column property assign.

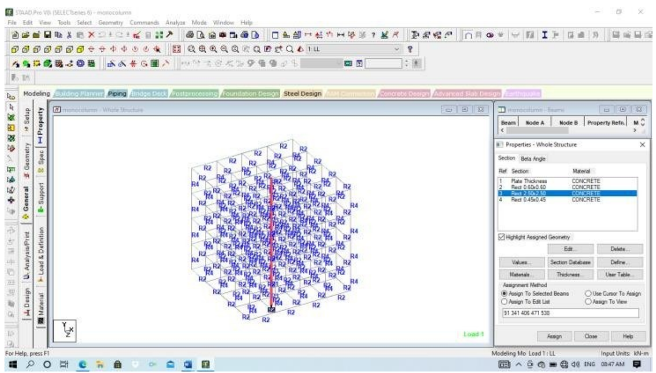

Fig.3.3. Mono column assign.

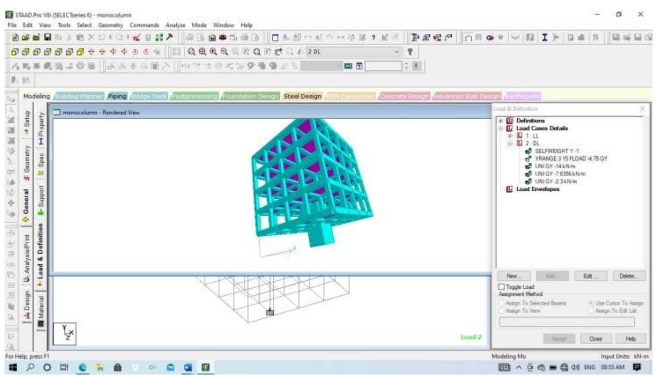

Fig.3.4. 3d view.

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

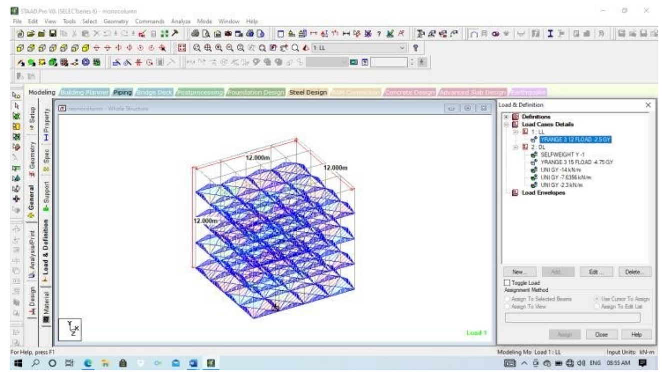

Fig.3.5. The structure under live load.

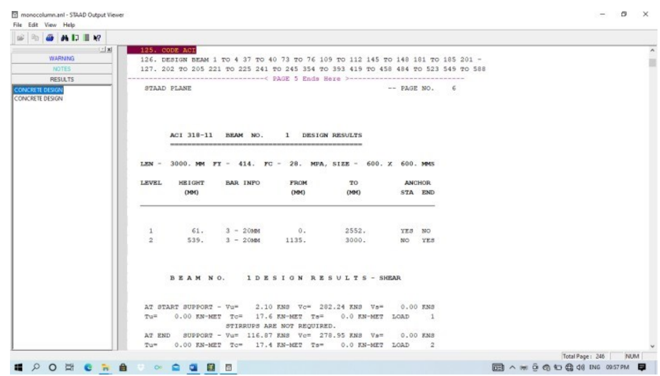

Fig.3.6. Stadd output quanties.

CONCLUSION

This project has been selected with utmost enthusiasm and keen interest by us and has been successfully completed with our knowledge to our satisfaction. The project Building with Mono Column (single supported building) is analyzed and designed with special attention and it is completed. Maximum space utilization is considered while planning and designing and we assure it will serve its maximum serviceability.

ISSN 2347–3657
Volume 7, Issue 3, 2019

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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