

Design And Analysis Of Mono Column Building By Using STAAD Pro

T.Subramani¹, S.Priyanka², E.Sahul Hameeth³, P. Shanmuga Subramani⁴, K.R. Shuresh⁵

¹Professor & Dean, Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, India

^{2,3,4,5}UG Student, , Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, India

ABSTRACT

The principle cause of this study is to layout a whole building relaxation on single column designed. The express boost in population and scarcity of land tends to the progress of construction technology and high rise marketable structure. This venture describes making plans, structural analysis, design and drawings with various additives and approximate price of the entire building. The proposed site is positioned at Salem. This building is composed. Single column is out of the ordinary mono column structure. The proposed plan prepared using AutoCAD with 190Sq.m total area plan, section, elevations shown in document. Both analytical and manual calculations are described for proposed building.

Keywords: Building, Single Column, Autocad and Mono Column

1. INTRODUCTION

Structure supported on a single column provides better architectural view compared to structure supported on many columns. They save ground space as requires less area for providing foundation and provides more space for parking. They are also unique. Single column structure Can be made both with the aid of the use of RCC or metallic. RCC systems are greater common now days in India. It has a incredibly high compressive strength and higher hearth resistance than steel. It has lengthy provider life with low preservation price. It is able to be cast into any required form. STAAD Pro is a structural study and propose computer program at foremost evolve by way of study Engineers worldwide in Yorba Linda. The motive for taking in this undertaking is to layout an entire constructing rest on single column. And the way the distinctive components are designed is given under in detailed.

1.1 Objectives

- To study the performance of lateral displacement at different zones
- To observe the behavior of wind force on irregular shape under zones

1.2 Building Orientation

The building is orientated in one of this manner that it's far going to serve with lighting and air move with simple right of entry to the entire amenities. Simple centers in residential building are given as in keeping with the NBC hints. First ground includes the man or woman of the house that includes bed rooms, kitchen, hall, separate toilets, dining hall and pooja room.

2. METHODOLOGY

Figure 1 shows the methodology of the study.

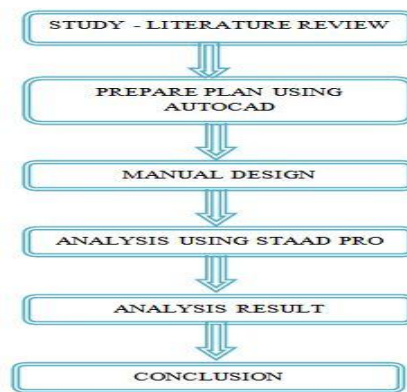


Figure 1 Methodology

3. STRUCTURE DETAILS

Foundation depth = 0.23m

Supports = All are fixed Supports

Number of stores = G + 1

Height of the each floor = 3m

Total height of the building = 6m

Size of the beam = 400 mm x 230 mm

Diameter of the column = 300mm x300mm

Central column = 1500mm x150mm

Height of the parapet wall = 1.0m

Seismic zone: zone = III

Wind load = zone- 3

Figure 2 shows the Flooring layout.

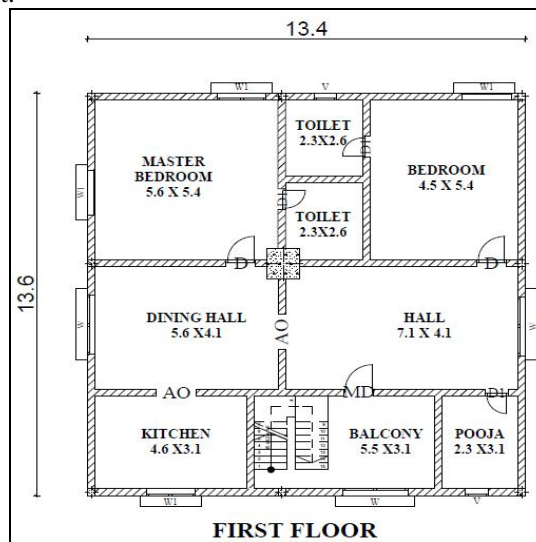


Figure 2 Flooring layout

Figure 3 shows the Elevation of the Building.

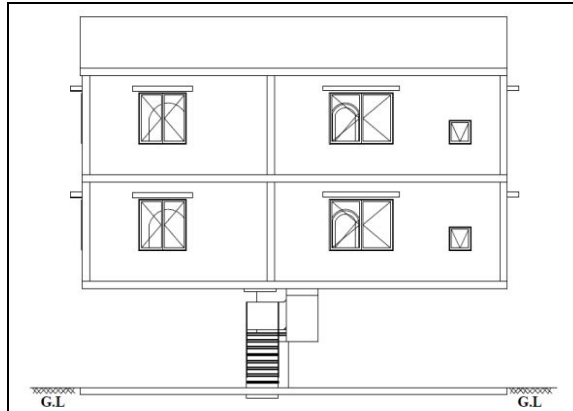


Figure 3 Elevation of the Building

Figure 4 shows the section of the building.

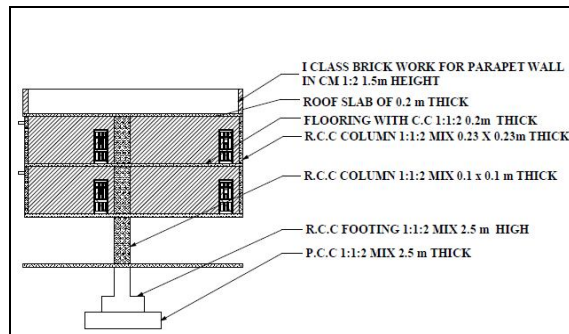


Figure 4 Section of the Building

4. MANUAL DESIGN

4.1 Design Two way Slab

4.1.1 Type of Slab

$$l_y / l_x = 7.1/4.1 = 1.73 < 2$$

Hence designed as two way slab

4.2.2 Check for Shear

$$\text{Nominal shear force } V_u = 10.125 \times 4.23 / 2 = 21.41 \text{ kN}$$

$$\text{Nominal shear force } \tau_c = V_u / bd$$

$$\tau_c = 0.16 \text{ N/mm}^2$$

$$\tau_c = 0.29 \text{ N/mm}^2 \text{ \& } k = 1.3$$

$$K\tau_c = 1.3 \times 0.29$$

$$K\tau_c = 0.37 \text{ N/mm}^2$$

$$\tau_{c \max} / 2 = 3.1/2 = 1.55 \text{ N/mm}^2$$

$$\tau_c < k\tau_c < \tau_{c \max} / 2$$

Hence safe in the shear

4.2 Simply Supported Beam

4.2.1 Load Calculation

$$\text{Total load} = 25.84 \text{ kN/m}$$

$$\begin{aligned} \text{Factored load} &= 25.84 \times 1.5 \\ F_d &= 38.76 \text{ kN/m} \end{aligned}$$

4.2.2 Factored Moment

$$\begin{aligned} M_u &= (F_d \times l_{\text{eff}}^2)/8 = (38.76 \times 7.33^2)/8 \\ M_u &= 260.3 \text{ kNm} \end{aligned}$$

4.2.3 Size of Beam

$$D = 500 \text{ mm}$$

4.2.4 Type of Section

$$\begin{aligned} M_{u\text{lim}} &= Q_u b d^2 = 3.45 \times 300 \times 360^2 \\ M_{u\text{lim}} &= 134.136 \times 10^6 \text{ N.mm} \end{aligned}$$

$$M_{u\text{lim}} < M_u$$

$$\begin{aligned} \% A_{st} &= A_{st} / b d \times 100 \\ &= 2384.5 / 300 \times 360 \times 100 \end{aligned}$$

$$\% A_{st} = 2.20 \%$$

$$\tau_c = 0.842 \text{ N/mm}^2$$

$$\tau_v \geq \tau_c$$

$$1.31 \text{ N/mm}^2 \geq 0.842 \text{ N/mm}^2$$

Provide Shear Reinforcement,

$$\begin{aligned} V_{us} &= V_u - \tau_c b d \\ V_{us} &= 51.11 \times 10^3 \text{ N.} \end{aligned}$$

4.2.5 Check For Stiffness

$$\begin{aligned} \% A_{st} \text{ @ mid span} &= 2384.5 \times 100 / 300 \times 360 \\ &= 2.2 \%$$

Stress in tension reinforcement,

$$\begin{aligned} F_s &= 0.58 F_y \text{ (Astreq / Astpro)} \\ &= 198.2 \text{ Curve} \end{aligned}$$

$$MF = 0.93$$

$$\begin{aligned} d &= 7330 / 32 \times 0.93 \\ &= 246.30 \text{ mm} < 360 \text{ mm} \end{aligned}$$

Hence it is Safe

4.3 Design Of Square Column

$$\text{Beam loads} = 166 \text{ kN}$$

$$\text{No of floor consideration} = 166 \times 2 = 332 \text{ Kn}$$

4.3.1 Design Load

$$P_u = W \times 1.5 = 166 \times 1.5$$

$$P_u = 249 \text{ kN}$$

4.3.2 Design Load

$$P_u = 249 \text{ kN}$$

4.3.3 Result

$$\text{Size of column} = 600 \times 600 \text{ mm}$$

$$\text{Longitudinal reinforcement} = 5\text{nos of } 16 \text{ mm}$$

$$\text{Transverse reinforcement} = 6 \text{ mm dia at } 260 \text{ mm c/c}$$

4.4 Square Footing For Square Column

4.4.1 Size of Footing

$$B = 1.4 \text{ m}$$

$$L = 1.4 \text{ m}$$

$$\text{Area of footing} = 1.4 \times 1.4 = 1.96 \text{ m}^2$$

4.4.2 Net Upward Design Pressure

$$F_0 = 332 \times 1.5 / 1.96 = 254.08 \text{ kN/m}^2$$

4.4.3 Transverse Shear

$$V_u = f_o \times \text{length} \times (0.4 - 0.18) = 78.256 \text{ kN}$$

$$\tau_v = V_u / bd = 78.256 \times 10^3 / 1400 \times 180$$

$$\tau_v = 0.31 \text{ N/mm}^2$$

$$\tau_c = 0.32 \text{ N/mm}^2$$

$$K\tau_c = 1.3 \times 0.32 = 0.416 \text{ N/mm}^2$$

$$\tau_v < K\tau_c \text{ Safe in shear.}$$

4.4.4 Check for SBC of Soil

$$\text{Column load} = 332 \text{ KN}$$

$$\text{Weight of footing} = 1.4 \times 1.4 \times 0.23 \times 25 = 11.27 \text{ kN}$$

$$\text{Total load on soil} = 343.27 \text{ kN}$$

$$\text{Pressure on soil} = 343.27 / (1.4 \times 1.4) = 175.13 \text{ kN/m}^2$$

$$175.13 \text{ kN/m}^2 < 200 \text{ kN/m}^2$$

Hence safe

5. ANALYSIS REPORT

Figure 5 shows the 2D Structure View of the study.

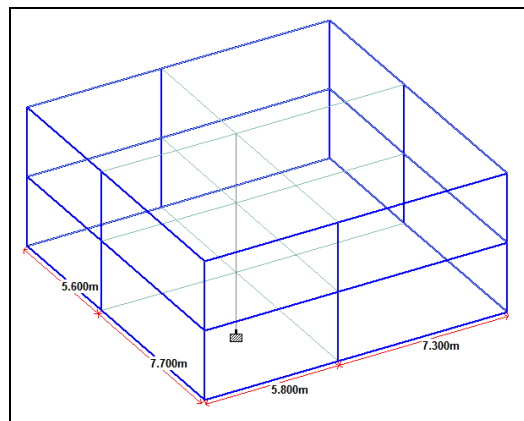


Figure 5 2D Structure View

Figure 6 shows the 3D Structure view of the study.

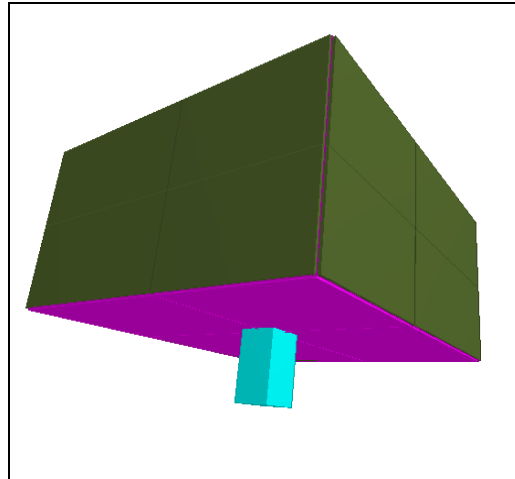


Figure 6 3D Structure View

Figure 7 shows the Maximum Absolute Pressure.

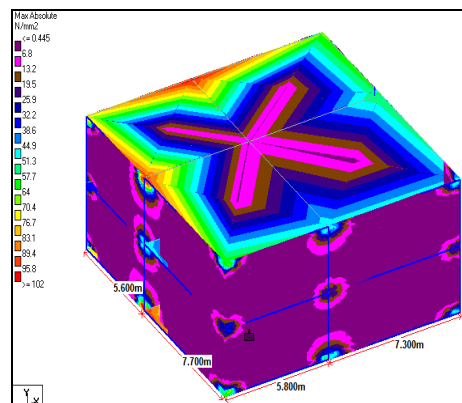


Figure 7 Maximum Absolute Pressure

Figure 8 shows the Greatest Supreme Pressure - Contour Line

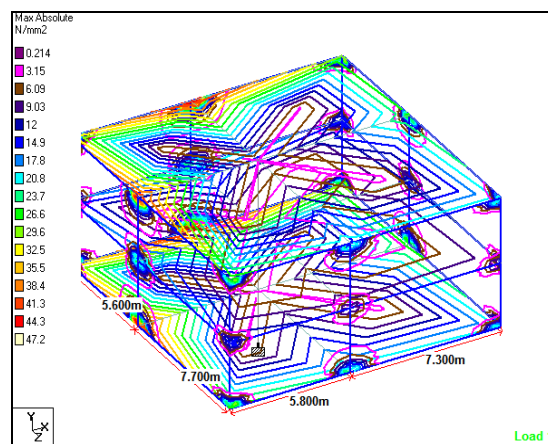


Figure 8 Greatest Supreme Pressure - Contour Line

6. CONCLUSION

We finish our venture with complete satisfaction that we're designed the undertaking. Two - storey constructing resting on single column with the aid of using of the automobile CAD making plans. The restrict nation method of

format is followed. We had completed the layout elements of the shape manually and software program application. Single column shape offers better architectural view and free ground space even though it costs bit extra than multi column shape. Single column form has been designed successfully to withstand all hundreds which include earthquake and wind load.

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AUTHOR



Prof. Dr. T. Subramani Working as Professor and Dean of Civil Engineering in Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. Having more than 28 years of Teaching experience in Various Engineering Colleges. He is serving as reviewer for many International Journals and also published 250 papers in International Journals. He has presented more than 107 papers in conferences, especially 77 in International and 30 National Level. He has authored 07 books. Guided more than 259 students in PG projects. Currently he is guiding 03 Ph.D., Research Scholars. He is serving as examiner and Valuer for B.E & M.E Degree Theory and Practical Examinations for Madras University, Periyar University, Anna University, Annamalai University and Vinayaka Missions Research Foundation [Deemed to be University]. He is Question paper setter and Valuer for UG and PG Courses of Civil Engineering in number of Universities. He is serving as Chairman of Board Of Studies (Civil Engineering), Vinayaka Missions Research Foundation [Deemed to be University], also a member of Board of studies in Periyar University. He is Life Fellow in Institution of Engineers (India) and Institution of Valuers. Life member in number of Technical Societies and Educational bodies like MISTE, MIGS, MIRC,ISRMTT, UWA, Salem District Small and Tiny Association (SADISSTIA), SPC – Salem Productivity Council. He has delivered much technical talk in various field. He is a Chartered Civil Engineer and Approved Valuer for many banks. He is a Licensed Building Surveyor in Salem City Municipal Corporation-Salem, and Licensed Civil Engineer in Salem Local Planning Authority- Salem. He is the recipient of many prestigious awards.



S.Priyanka is persuing B.E. Degree in the branch of Civil Engineering in Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. She published 30 papers in International Journals. She has presented more than 13 papers in conferences, especially 8 in International and 5 National Level. She has well knowledge in AUTOCAD drawing and STAAD Pro



E.Sahul Hameeth completed his Diploma in the branch of civil engineering in Salem Polytechnic College , Salem, Tamil Nadu, India and now he is perusing his B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. Salem. He has well knowledge in AUTOCAD drawing. His hobbies are playing Basketball, Hockey and Cricket



P. Shanmuga Subramani is perusing B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. Salem. He has well knowledge in AUTOCAD drawing. His hobbies are playing Volleyball, drawing, Reading books



K.R. Shuresh is perusing B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. Salem. He has well knowledge in AUTOCAD drawing and STAAD Pro Analysis. He is very much interested in sports and he won zonal prices in shotput and relay.