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Seismic Analysis of the Multistory Building Frames With Different Geometry of Columns & Beams

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Abstract – *In this research work the seismic analysis of the multistory building frame structure with three different plan having a different geometry of 230mm x 230mm, 300mm x 300mm and 380mm x 380mm with constant geometry of columns and beams in each case. The building plan is symmetrical 24.38x24.38m of G+10 storey which is situated in seismic zone III, medium soil, response reduction factor 1.5 and damping ration 0.05 etc parameters are used. The analysis of the structure as per IS 1893 Part-I:2002, linear static methods by using Staad Pro V8i software. The structure analyzed in the term of support reaction, reaction moment, and axial force and found that the maximum support reaction and axial force at plan category Plan 'A' and minimum at 'C' while the maximum reaction moment at Plan 'C' and minimum at plan 'A'.*

***Key Words*: Seismic Zone, Soil, Multi-storey building, Staad Pro etc.**

1. INTRODUCTION

In all over the world the earthquakes have becomes a frequent event and very difficult to predict the intensity, location and occurrence of time of the earthquakes.in the design of the structures adequately for usual loads like dead load, wind loads etc. and the design approach adopted as Indian standard IS 1893 part-I:2002 "criteria for the Earthquake Resistant Design of the Structures" and is ensure that the structures possess at least a minimum strength to withstand minor occurring frequently the earthquake without any damage, resist the earthquakes without any significance structural damage through the some non-structural damage may occurs and the structure withstand the major earthquake without collapse.

Seismic loading requires an understanding of the structural behavior under large inelastic deformations. Behavior under this loading is fundamentally different from wind or gravity loading, requiring much more detailed analysis to assure acceptable seismic performance beyond the

Elastic range. Some structural damage can be expected when the building experiences design ground motions because almost all building codes allow inelastic energy dissipation in structural system.

1.1 LITERATURE SURVEY

1.D.R. Deshmukh, A.K. Yadav etc -He analyzed and design G+19 storied RC Building frame by using the Staad pro software, to analyzed and design of multi storey building frame which located in Pune city in seismic zone III and as per IS code, the value of seismic zone coefficient was taken as 0.06.

2.Narla Mohan etc all (2017)-He studied the comparative of Seismic and Wind analysis of the G+20, RC multistory commercial building frame with all seismic zone and different basic wind speed by using Etabs programming software.

1.2 OBJECTIVE THE WORK

In this work the seismic analysis of the symmetrical building frame structure of 24.38m X 24.38m along to X and Z direction of G+10 storey, which is located to seismic zone III with medium soil conditions.

There are main objective of this works:

1 How to seismic evaluation of a building should be carried out.

2 To study the behavior of the structure under the action of Seismic Loads.

2. METHODOLOGY

In this work the Linear static Analysis method are adopted by using Staad Pro V8i software with different parameters like medium soil, damping ratio 0.05, R.F. 5, Importance factor 1.5 for important structures.

Following method are adopt:

a. Building Plan of the structure with geometry and 3D frame.

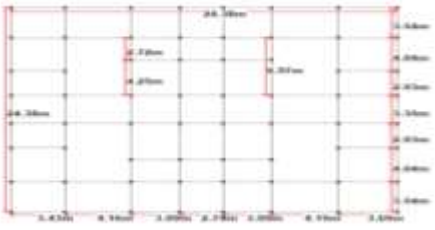


Fig.2.1 Building Plan

b. Selection of the seismic zone III as per IS 1893 Part-I:2002

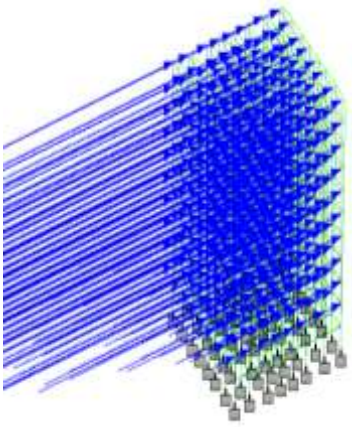
Seismic zone	II	III	IV	V
Intensity	Low	Moderate	Severe	Very Severe
Z	0.10	0.16	0.24	0.36

c. Load Combinations:

Load Case Number	Load Case
1	DL
2	LL
3	EQ X
4	EQ Z
5	1.5(DL+LL)
6	1.5(DL+EQ X)
7	1.5(DL-EQ X)
8	1.5(DL+EQ Z)
9	1.5(DL-EQ Z)
10	1.2(DL+LL+EQ X)
11	1.2(DL+LL-EQ X)
12	1.2(DL+LL+EQ Z)
13	1.2(DL+LL-EQ Z)

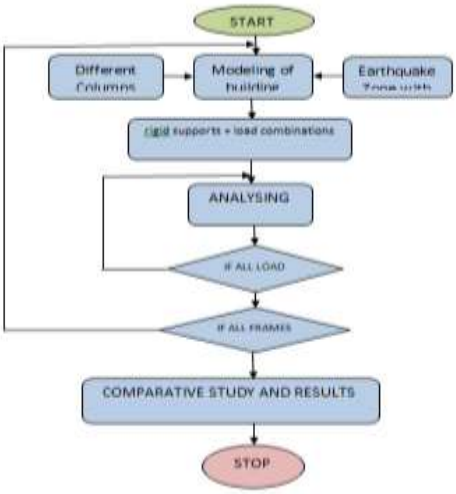
d. The building frame structure designing in 3D frame using Staad Pro v8i programming software.

e. Analysis of the Building Frame structure on seismic zone III, with different geometry of columns. Fig shows Seismic load.



f. Comparative analysis of the structure in the term of maximum support reaction, maximum reaction moment, maximum axial force.

Flow Chart Digram



2.2 MATERIAL AND GEOMERICAL PROPERTIES

We have been considered the following materials and geometrical properties.

Density of R.C.C.: 25 KN/m^3
Density of Masonry: 20 KN/m^3.

Type of Plan Category with Geometry details

Name of Plan	Member Name	Geometry/Section	Remarks
Plan "A"	Columns	230mm X230mm	Constant Geometry for whole structure
	Beams	230mm X230mm	
Plan "B"	Columns	300mm X 300mm	Constant Geometry for whole structure
	Beams	300mm X 300mm	
Plan "C"	Columns	380mm X 380mm	Constant Geometry for whole structure
	Beams	380mm X 380mm	

Details of the Dead Loads

Brick Masonry Wall Loads					Remarks
For Floor Height 3.2 m	=	0.25m x (3.2-0.23)m x 20 KN/m^3	14.85	KN/m	PLAN A
For Floor Height 3.2 m	=	0.25m x (3.2-0.30)m x 20 KN/m^3	14.50	KN/m	PLAN B
For Floor Height 3.2 m	=	0.25m x (3.2-0.38)m x 20 KN/m^3	14.10	KN/m	PLAN C
Parapet wall	=	0.25m x ()m x 20 KN/m^3	5.0	KN/m	
Floor Load					
Slab Load	=	0.15m x 25kN/m^3	3.75	KN/m^2	Assumed 150mm thick slab
Floor Finish	=		1	KN/m^2	
Total Load	=		4.75	KN/m^2	

(b) Live Loads: Live load are taken as IS: 875 (part-II) 1987
Live load on typical floors ..... 3 KN/m²
Live load on seismic calculation ..... 0.75 KN/m²
(c) Earthquake loads: All the building frame are analyzed in earthquake zone III and the seismic load calculation as per IS: 1893 (2002)

Table-4.3 Seismic Force Parameters for Proposed issue

S.No.	Parameter	Value	As IS per Code
1.	Zone- III	0.16	Table -2
2.	Damping Ratio	0.05	Table-3
3.	Importance Factor (I)	1.5	Table-6
4.	Response Reduction Factor (R.F.)	5	Table-7
5.	Soil Site Factor (S.S.)	Medium Soil	

3. ANALYSIS AND RESULTS

3.1 SUPPORT REACTION

Table 3.1 Support Reaction

PLAN CATEGORY	SUPPORT REACTION IN KN
PLAN A	5518.382
PLAN B	5238.529
PLAN C	5054.373

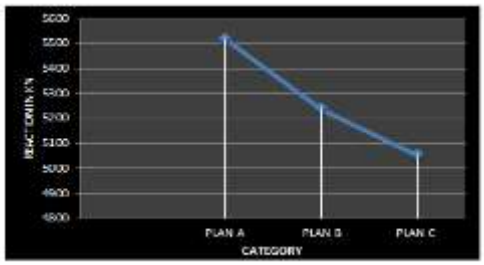


Fig. 3.1 Support Reaction

3.2 SUPPORT REACTION MOMENT IN X DIRECTION

Table 3.2 Support Reaction Moment in X Direction

PLAN CATEGORY	SUPPORT REACTION MOMENT IN X DIRECTION (KN-m)
PLAN A	311.976
PLAN B	323.942
PLAN C	343.894

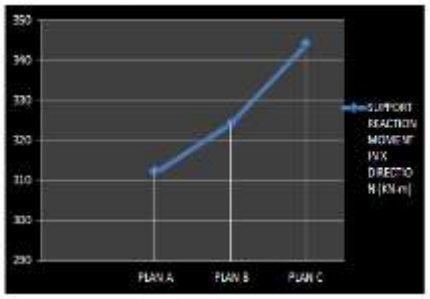


Fig. 3.2 Support Reaction Moment in X Direction

3.3 SUPPORT REACTION MOMENT IN Z DIRECTION

Table 3.3 Support Reaction Moment in Z Direction

PLAN CATEGORY	SUPPORT REACTION MOMENT IN Z DIRECTION (KN-m)
PLAN A	321.35
PLAN B	336.094
PLAN C	357.481

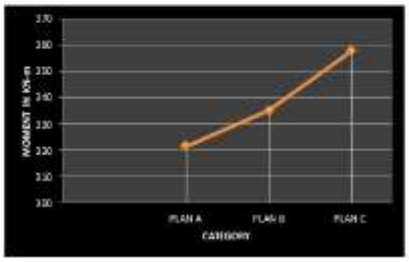


Fig. 3.3 Support Reaction Moment in Z Direction

3.4 MAXIMUM AXIAL FORCE

Table 3.4 Maximum Axial force

PLAN CATEGORY	AXIAL FORCE IN KN
PLAN A	5512.399
PLAN B	5228.35
PLAN C	5038.042

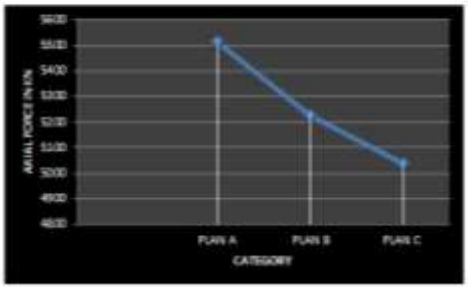


Fig. 3.4 Maximum Axial force

3. CONCLUSIONS

- The maximum support reaction is carried out at plan category Plan 'A' and Minimum at Plan 'C' that means support reaction decreased with increasing the geometry of the member.

- The reaction moment if found that the plan category Plan C and minimum at plan 'A' that means that if the geometry increased then reaction moment is also increased.

- The maximum axial force is observed at plan category Plan 'A' and minimum at plan 'C' that means the axial force is decreased with increased the geometry of the column and beams.

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