Seismic load on high rise building in new metro city

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ABSTRACT

The principle objective of this project is to comparison between RCC design a multi-storeyed building using STAAD Pro. The design involves load calculations and analyzing the whole structure by STAAD Pro. The design methods used in STAAD Pro analysis are Limit State Design conforming to Indian Standard Code of Practice. The Thesis involves Staad Modeling, Analysis the members due to the effect of Seismic load for a 120 meter height Building with Concrete & Steel construction. The proposal structure is a 30 storied building with 3.5 m as the height of each floor. The overall plan dimension of the building is20.0 m x 20.0m.

Keyword : - *Dead Load, Live Load, Seismic Load for RCC structure*

1. Introduction & Objective

The focus of this study, in the field of Seismic and earthquake engineering, is on the comparison of the dynamic behavior of a multi-story reinforced concrete & how they respond to Seismic and earthquake induced excitations. Tall buildings are often of complex geometry while the building design codes, used to evaluate the dynamic properties of structures in the design phase, are based on simplified generic assumptions, which are primarily appropriate for relatively simple structures. Therefore a full-scale validation of dynamic behavior of buildings undergoing Seismic and earthquake excitations is important.

1.1 METHODOLOGY

In this paper a 3-D model ion staad pro has been developed to analyze the behavior of reinforced concrete tall building structure building under Seismic loads. This paper explain briefly also the effect of Seismic loads on the structures for the study between Seismic effects on RCC framed building. Importance factor of building and finally soil factor were talking into considerations and there effects on the performance of tall buildings were discussed. Our purpose is to analyse & design both the structure & study the effect on foundation & as well as the effect on costing of material for construction purpose. The model has been designed for 30 storied building & this comparison will guide us in choosing the type of structure for a 120m height building.

1.2 STAAD MODEL FOR CONCRETE STRUCTURE

3.LOAD PARAMETERS

Dead Load

- SELF WEIGHT OF RCC SLAB
- BRICK WALL LOAD
- SELF WEIGHT OF BEAM & COLUMNS OF STRUCTURE

Live Load

2 KG/ m2 As per IS 1893.

Seismic Load

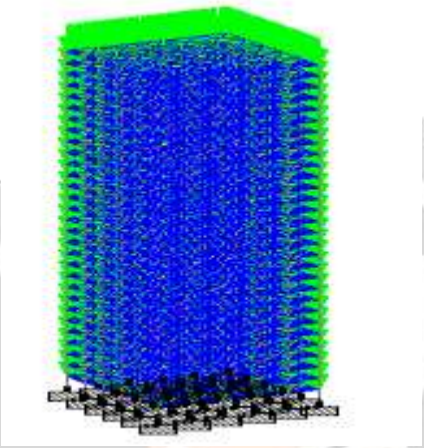
- BASIC AS PER zone III (IS 1893 (part 1):2002)
- SEISMIC : As per IS 1893.

4.DATA REQUIRED FOR THE ANALYSIS OF THE FRAME..

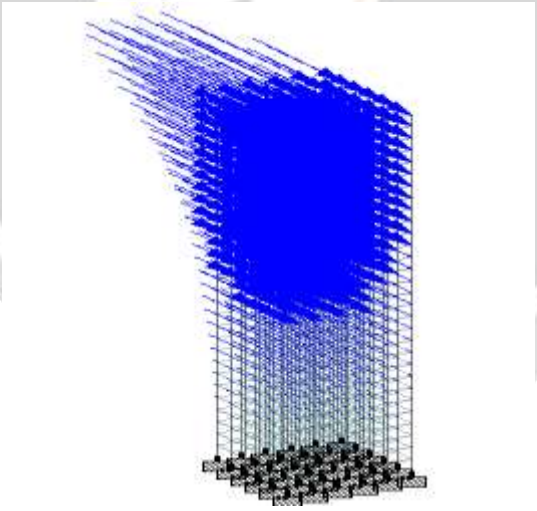
Type of structure	multi-storey fixed jointed plane frame
BUILDING TYPE	RENFORCED CONCRETE FRAME
Usage	Comarsial apartment
Location	Bhopal, Indore M.P.
Number of stories	Open Ground + 30
Plan dimensions	20mX20m
Building height	120m
Floor height	3.5m
No of bays and bay length	4nos,4 m each.
Imposed load	2 kn/m2
floor and	1.5 kn/m2 on roof.
Materials Concrete	M 30
Reinforcement	fe415
Size of column	0.70m×0.65m
Size of beam	.60m×.55m
Depth of slab	150 mm thick
Specific weight of RCC	25kn/m3.
Specific weight of infill	19.2 kn/m3
Type of soil	Medium soil.
Response spectra	As per IS 1893.
Seismic zone	zone III (IS 1893 (part 1):2002)

Table:1 Data Description

5.Application of DEAD LOAD & LIVE LOAD



Dead Load & Live Load has been applied on the structures. Load of floor slab has been applied as Floor Load & Brick Wall Load has been applied as member Load. Self Weight of the structure also being applied.



Application of Seismic load along +Z direction

FIG: **SEISMIC load In Z Direction**

Seismic Load has been calculated in pressure co-efficient method for cladded building. On the basis of the intensity & influence area of the seismic the seismic load has been applied as member load on the structure

Application of Seismic load along +X direction

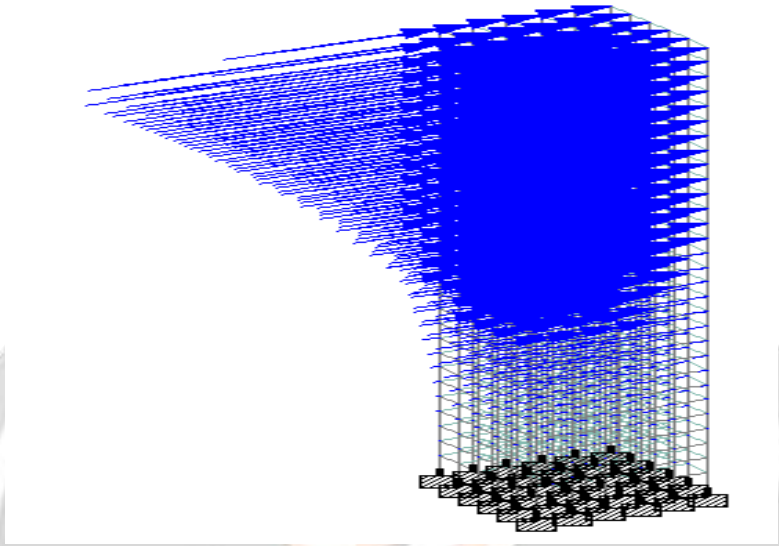


FIG: SEISMIC load In X Direction

Seismic Load has been calculated in pressure co-efficient method for cladded building. On the basis of the intensity & influence area of the seismic the seismic load has been applied as member load on the structure

Graphical Representation of Displacement on Structure

Seismic Load on RCC Structure

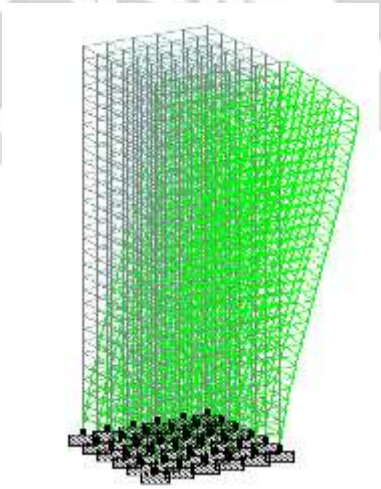


FIG: Displacement In X direction

Above Displacement diagram shows the effect on the RCC structure when Seismic load is applied on the structure at +X direction.

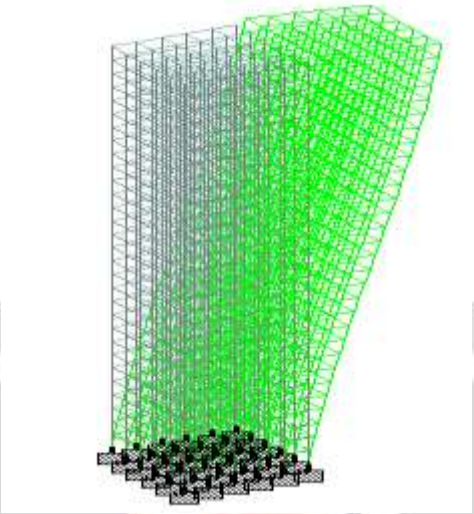


FIG: Displacement In -X direction

Above Displacement diagram shows the effect on the RCC structure when Seismic load is applied on the structure at -X direction.

STATIC LOAD/REACTION/EQUILIBRIUM SUMMARY FOR CASE NO. 2

LOADTYPE SEISMIC TITLE Z

CENTER OF FORCE BASED ON Z FORCES ONLY (METE).

(FORCES IN NON-GLOBAL DIRECTIONS WILL INVALIDATE RESULTS)

X = 0.100000000E+02

Y = 0.798283500E+02

Z = 0.100000001E+02

***TOTAL APPLIED LOAD (KN METE) SUMMARY (LOADING 2)

SUMMATION FORCE-X = 0.00

SUMMATION FORCE-Y = 0.00

SUMMATION FORCE-Z = 1484.93

SUMMATION OF MOMENTS AROUND THE ORIGIN-

MX= 118539.15 MY= -14849.25 MZ= 0.00

***TOTAL REACTION LOAD(KN METE) SUMMARY (LOADING 2)

SUMMATION FORCE-X = -0.00

SUMMATION FORCE-Y = 0.00

SUMMATION FORCE-Z = -1484.93

SUMMATION OF MOMENTS AROUND THE ORIGIN-

MX= -118539.15 MY= 14849.25 MZ= 0.00

MAXIMUM DISPLACEMENTS (CM /RADIANS) (LOADING 2)

	MAXIMUM	AT NODE
X	1.41386E-04	72
Y	-3.14305E-01	1042
Z	5.50546E+00	1114
RX	5.58989E-04	577
RY	1.58797E-06	72
RZ	-2.75149E-06	319

EXTERNAL AND INTERNAL JOINT LOAD SUMMARY (KN METE)-

JT	EXT FX	EXT FY	EXT FZ	EXT MX	EXT MY	EXT MZ	INT FX	INT FY	INT FZ	INT MX	INTT MY	INT MZ
1	0	0	0	0	0	0	0.56	761.5	33.19	88.12	-0.12	-0.71
2	0	0	0	0	0	0	0.08	773.9	34.02	89.14	-0.02	-0.13
3	0	0	0	0	0	0	0.05	775.7	34.06	89.22	0	-0.05
4	0	0	0	0	0	0	-0.03	775.7	34	89.22	0	0.05
5	0	0	0	0	0	0	-0.08	773.9	34.02	89.14	2	0.13
6	0	0	0	0	0	0	-0.56	761.5	33.19	88.12	0.12	0.71
7	0	0	0	0	0	0	0.03	283.9	44.15	100.44	0.01	-0.06
8	0	0	0	0	0	0	0.02	286.7	45.29	101.75	0	0.04
9	0	0	0	0	0	0	0.01	287.9	45.33	101.82	0	-0.01

10	0	0	0	0	0	0	-0.01	287.9	45.33	101.82	0	0.01
11	0	0	0	0	0	0	-0.02	28.76	45.29	101.75	0.01	0.04
12	0	0	0	0	0	0	-0.03	283.9	44.15	100.44	-0.01	0.06
13	0	0	0	0	0	0	0.01	82.25	44.32	100.71	0.03	-0.01
14	0	0	0	0	0	0	0	83.4	45.45	102.01	0	0
15	0	0	0	0	0	0	0	83.4	45.45	102.01	0	0
16	0	0	0	0	0	0	0	83	45.42	101.95	0	0.01
17	0	0	0	0	0	0	-0.01	82.25	44.32	100.71	-0.03	0.02
18	0	0	0	0	0	0	-0.01	-82.25	44.32	100.71	0.03	0.02
19	0	0	0	0	0	0	-0.01	-53.06	45.42	101.95	0	0.01
20	0	0	0	0	0	0	0	-83.4	45.45	102.01	0	0
21	0	0	0	0	0	0	0	-83.4	45.45	102.01	0	0
22	0	0	0	0	0	0	0.01	-83	45.42	101.95	0	-0.01
23	0	0	0	0	0	0	0.01	-82.25	44.32	100.71	-0.03	-0.02
24	0	0	0	0	0	0	-0.03	-283.9	44.15	100.44	0.01	0.06
25	0	0	0	0	0	0	-0.02	-28.76	45.29	101.75	-0.01	0.04
26	0	0	0	0	0	0	-0.01	-287.9	45.33	101.82	0	0.01
27	0	0	0	0	0	0	0.01	-287.9	45.33	101.82	0	-0.01
28	0	0	0	0	0	0	0.02	-286.8	45.29	101.75	0.01	-0.04
29	0	0	0	0	0	0	0.03	-283.9	44.15	100.44	-0.01	-0.06
30	0	0	0	0	0	0	-0.56	-71.47	33.17	88312	-0.12	0.71

31	0	0	0	0	0	0	-0.08	-77389	34.02	89.14	-0.02	0.13
32	0	0	0	0	0	0	-0.03	-775.7	34	89.22	0	0.05
33	0	0	0	0	0	0	0.09	-775.8	34.06	89.22	0	-0.05
34	0	0	0	0	0	0	0.08	-773.9	34.02	89.14	0.02	-0.13
35	0	0	0	0	0	0	0.56	-773.9	34.02	89.14	0.02	-0.13
36	0	0	0	0	0	0	0.5	-761.5	33.17	88.12	0.12	-0.71

Table: Joint load on Z direction

CENTER OF FORCE BASED ON X FORCES ONLY (METE).(FORCES IN NON-GLOBAL DIRECTIONS WILL INVALIDATE RESULTS)

X = 0.100000000E+02

Y = 0.798283500E+02

Z = 0.100000001E+02

***TOTAL APPLIED LOAD (KN METE) SUMMARY (LOADING 1)

SUMMATION FORCE-X = 1484.93

SUMMATION FORCE-Y = 0.00

SUMMATION FORCE-Z = 0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-

MX= 0.00 MY= 14849.25 MZ= -118539.15

***TOTAL REACTION LOAD(KN METE) SUMMARY (LOADING 1)

SUMMATION FORCE-X = -1484.93

SUMMATION FORCE-Y = 0.00

SUMMATION FORCE-Z = -0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-

MX= -0.00 MY= -14849.25 MZ= 118539.15

MAXIMUM DISPLACEMENTS (CM /RADIANS) (LOADING 1)

	MAXIMUM	AT NODE
X	5.35254E+00	1093
Y	3.13818E-01	1021
Z	1.44348E-04	72
RX	3.11757E-06	330
RY	-1.60951E-06	72
RZ	-5.50135E-04	612

EXTERNAL AND INTERNAL JOINT LOAD SUMMARY (KN METE)-

JT	EXT FX	EXT FY	EXT FZ	EXT MX	EXT MY	EXT MZ	INT FX	INT FY	INT FZ	INT MX	INTT MY	INT MZ
1	0	0	0	0	0	0	33.13	757.28	0.53	0.67	0.12	-91.51
2	0	0	0	0	0	0	44.09	287.81	0.04	0.06	-0.01	-103.75
3	0	0	0	0	0	0	44.36	83.56	0.01	0.02	-0.03	-104.14
4	0	0	0	0	0	0	44.36	-83.56	-0.01	-0.02	-0.03	-104.14
5	0	0	0	0	0	0	44.09	-287.81	-0.04	-0.06	-0.01	-103.75
6	0	0	0	0	0	0	33.13	-757.28	-0.53	-0.67	0.12	-91.51
7	0	0	0	0	0	0	33.98	770.24	0.07	0.12	0.02	-92.57
8	0	0	0	0	0	0	45.27	291.04	0.02	0.03	0.01	-105.12
9	0	0	0	0	0	0	45.5	84.46	0.01	0.01	0	-105.43
10	0	0	0	0	0	0	45.5	-84.46	-0.01	-0.01	0	-105.43
11	0	0	0	0	0	0	33.98	-770.24	-0.07	-0.12	0.02	-92.57
12	0	0	0	0	0	0	34.03	772.16	0.03	0.04	0	-92.65
13	0	0	0	0	0	0	45.32	292.24	0.01	0.01	0	-105.19
14	0	0	0	0	0	0	45.54	84.83	0	0	0	-105.5
15	0	0	0	0	0	0	45.54	-84.83	0	0	0	-105.5
16	0	0	0	0	0	0	45.32	-292.24	-0.01	-0.01	0	-105.19

17	0	0	0	0	0	0	34.03	-772.16	-0.03	-0.04	0	-92.65
18	0	0	0	0	0	0	34.03	772.16	-0.03	-0.04	0	-92.65
19	0	0	0	0	0	0	45.32	292.24	-0.01	-0.01	0	-105.19
20	0	0	0	0	0	0	45.54	84.83.	0	0	0	-105.5
21	0	0	0	0	0	0	45.54	-84.83	0	0	0	-105.5
22	0	0	0	0	0	0	45.32	-292.24	0.01	0.01	0	-105.19
23	0	0	0	0	0	0	34.03	-772.16	0.03	0.04	0	-92.65
24	0	0	0	0	0	0	33.98	770.24	-0.07	-0.12	-0.02	-92.57
25	0	0	0	0	0	0	45.27	291.04	-0.02	-0.03	-0.01	-105.12
26	0	0	0	0	0	0	45.5	84.44	-0.01	-0.01	0	-105.43
27	0	0	0	0	0	0	45.5	-84.46	0.01	0.01	0	-105.43
28	0	0	0	0	0	0	45.27	-291.04	0.002	0.03	0.01	105.12
29	0	0	0	0	0	0	33.98	-770.24	0.07	0.12	-0.02	-92.57
30	0	0	0	0	0	0	33.13	757	0.28	-0.53	-0.12	-91.51
31	0	0	0	0	0	0	44.09	287.81	-0.04	-0.06	0.01	-105.75
32	0	0	0	0	0	0	44.36	-83.56	-0.01	-0.02	0.03	-104.14
33	0	0	0	0	0	0	44.36	-83.56	0.01	0.02	0.03	-104.14
34	0	0	0	0	0	0	44.09	-287.81	0.01	0.06	0.01	-103.75
35	0	0	0	0	0	0	33.13	-757.28	0.5	0.67	-0.1	-91.51

Table: Joint load on X direction

6. CONCLUSIONS

The purpose of this project was to assess the seismic load in an RC frame which provi.de an batter result in M.P. Indore Bhopal region. The building under study in this project was an existing multi-storey building in Indore Bhopal Region the plan and reinforcement should be provide. I modeled the building in STAAD PRO software and applied the seismic load combination to it Equivalent static procedure as per Indian Standard IS 1893:2002 (Part 1)and IS 875 was used to compute the seismic forces The results for first floor beams and a large sample of columns showed that a number of beams and all the foundation columns checked were found to be deficient under the applied seismic load combinations. Number of beams under flexure was more than the number of beams under shear. The dcr of columns under biaxial bending gradually decreased with height,

although it was greater than one in most of the cases.

For providing retrofit measures for the deficient members, concrete jacketing was found to be a suitable method for retrofitting of columns. It was also concluded that steel plating would be an efficient method of retrofitting of a number of deficient beams.the behavior of multi-storey building frames under the different seismic load and the different ground slope. Considered seismic load on different type of building frame have been analyzed. The results obtained from the analysis are represented by tables and graphs and also plane ground and sloping ground in degree are also compared in Tables and Graphs

7. REFERENCES

1. IS 456.
2. IS 1893 (for seismic analysis). STAAD-Pro user guide.