INTERNATIONAL JOURNAL OF RESEARCH
In Advanced Engineering Technologies

Volume 5, Issue 4 SEP 2016

THE ANALYSIS & DESIGN OF MULTI STORIED BUILDING WITH CONSIDERING SEISMIC LOADS

[1]MOHD. MUZAFFAR HUSSAIN, [2]A. SHRAVAN KUMAR, [3]S. RAJMOHAN REDDY

[1]M. Tech(Structural Engineering), Department of Civil Engineering, Kommuri Pratap Reddy Institute of Technology, Village Ghanapur, Mandal Ghatkesar, District Rangareddy, Telangana, India.

[2]Assistant Professor(M.Tech)(PH.D), Department of Civil Engineering, Kommuri Pratap Reddy Institute of Technology, Village Ghanapur, Mandal Ghatkesar, District Rangareddy, Telangana, India.

[3]Assistant Professor(M.Tech), Department of Civil Engineering, Kommuri Pratap Reddy Institute of Technology, Village Ghanapur, Mandal Ghatkesar, District Rangareddy, Telangana, India.

ABSTRACT-Consideration of site specific lateral loading because of wind or earthquake loads in conjunction with vertical gravity loads is very important for locating the behavior of the high rise buildings. Because the height of a building becomes taller, the quantity of structural material needed to resist lateral loads will increase drastically. The design of high rise buildings primarily involves an abstract design, approximate analysis, preliminary designing and optimization, to securely carry gravity and lateral loads. The planning criteria are strength, serviceableness and human comfort. The aim of the structural engineer is to attain appropriate structural schemes, to satisfy these criteria. within the present study, the limit state methodology of research and style of a G+21 structure ferroconcrete high rise building beneath wind and seismic loads as per IS codes of observe is represented. Safety of the structure is checked against allowable limits prescribed for accelerations prescribed in codes of observe and different relevant references in literature on effects of earthquake and wind loads on buildings.

1. INTRODUCTION

In general, for designing of high rise buildings both the wind as well as earthquake loads ought to be consider. Governing criteria for carrying out dynamic analyses for earthquake loads are totally different from wind loads. Consistent with the provisions of Bureau of Indian Standards for earthquake load, IS 1893(Part 1):2002, height of the structure, seismic zone, vertical and horizontal irregularities, soft and weak structure necessitates dynamic analysis for earthquake load. The contribution of the upper mode effects are enclosed in arriving at the distribution of lateral forces on the peak of the building. As per IS 875(Part 3):1987, once wind interacts with a building, both the positive and negative pressures occur at the same time, the building should have sufficient strength to resist the applied loads from these pressures to stop wind evoked building failure. Load exerted on the building envelope are transferred to the structural system and that they successively should be transferred through the inspiration into the bottom, the magnitude of the wind pressure may be a perform of exposed basic wind speed, topography,

building height, internal pressure, and building form. the most objective of this study is to hold out the analysis of G+21 multi keep residential building against earthquake and wind loads as per Indian standard codes of observe IS 1893(Part 1):2002 and IS 875(Part 3):1987. The member forces are calculated with load combinations for Limit State methodology given in IS 456: 2000 and therefore the members are designed for the foremost crucial member forces among them. The building is subjected to self weight, dead load, imposed load as per IS 875(Part 1, part 2):1987.

Statement of project

Salient features:

Utility of building: residential sophisticated

No of stories: G+21

Shape of the building: Rectangular

No of staircases: Two

No. of flats: thirty

No of lifts: Two

Type of construction: R.C.C framed structure

Types of walls: brick wall

Geometric details:

Ground floor: 3m

Floor to floor height: 3.3m

Height of support: 0.6m

Depth of foundation: 500mm

Materials:

Concrete grade: M_{30}

All steel grades: Fe415 grade

Bearing capability of soil: $300\frac{KN}{m^2}$

2. LITERATURE REVIEW

Baldev D. Prajapati et.al has study that the analysis & designing procedure adopted for the calculation of Corresponding author Pralobh S. Gaikwad may be a PG Student and Kanhaiya K. Tolani is functioning as radial high rise multi-storey building (G+30) beneath impact of equivalent weight and Wind forces. The R.C.C., Steel, & Composite building with shear wall is taken into account to resist lateral forces resisting system.

Wakchaure M.R et.al has investigated that study the impact of masonry walls on high rise building. Linear dynamic analysis is completed on high rise building with totally different arrangement is administered. Analysis is completed on G+9 R.C.C. framed building. Earthquake time history is applies to the models. Equivalent strut technique is employed to calculate the dimension of strut. Varied cases of research are taken. Analysis is administered by a software ETABS. Base shear, level displacement, story drift is calculated and every one models are compared.

Dr. B. Guru Premji I have taken the guidelines from the above said senior most scholar and senior most personality of JNTU Hyderabad., I have taken the guidelines in the analysis and design of multi storied building of my academic project of G+21. I am very much thankful to Dr. B. Guru Prem Sir.

3. LOADINGS

- Dead and live loads at plinth level (0.00)

Dead load of brick wall (230 mm thick) =0.23×20× (4-0.5) =16.1$\frac{KN}{m}$

Dead load of brick wall (115 mm thick) =0.125×20× (3.3-0.5) = 6.44$\frac{KN}{m}$

- Dead and live loads at Floor level:

Dead load of slab (200 mm assuming) =0.2×25 =5KN/m^2

Floor finish of 50mm = 0.05×24 = 1.2KN/m^2

Ceiling plaster = 0.006×20 = 0.12KN/m^2

False ceiling for all floors except ground floor = 0.5KN/m^2

For floors Total = 6.82KN/m^2

For ground level, we should not include false ceiling = 6.32KN/m^2

Live load (On floor, accessible) =3 KN/m^2

- Dead and live loads at Roof level:

Dead load of brick wall (200 mm thick) =0.20×0.45×25

(Parapet wall) = 2.07kN/m

Dead load of slab (125 mm assuming) =0.125×25 = 3.125KN/m^2

Water proofing =3KN/m^2

Total floor load = 3.125+3 = 6.125KN/m^2

Live load (On floor, accessible) =0.75KN/m^2

4. ANALYSIS OF STRUCTURAL FRAMES

	Node	L/C	Horizontal Fx N	Vertical Fy N	Horizontal Fz N
Max Fx	116	6	64309.433	1.16E+07	1709.781
Min Fx	235	7	-75353.439	1.09E+07	867.475
Max Fy	118	6	257.806	1.73E+07	1520.339
Min Fy	1	5	-24797.729	-5.57E+05	-33083.481
Max Fz	2	6	2035.391	1.18E+07	64297.531
Min Fz	348	13	-29762.739	7.86E+06	-75433.8
Max Mx	2	6	2035.391	1.18E+07	64297.531
Min Mx	348	13	-29762.739	7.86E+06	-75433.8
Max My	346	13	-226.83	5.50E+06	-57593.903
Min My	5	13	-49447.815	5.33E+06	-8288.059
Max Mz	235	13	-65964.371	7.40E+06	-40290.268
Min Mz	116	6	64309.433	1.16E+07	1709.781

	Node	L/C	Moment		
			Mx KNm	My KNm	Mz KNm
Max Fx	116	6	3.211	-0.047	-80.26
Min Fx	235	7	6.473	-0.718	157.756
Max Fy	118	6	0.936	-0.02	-0.509
Min Fy	1	5	-155.856	0.142	114.721
Max Fz	2	6	80.14	0.109	-3.22
Min Fz	348	13	-214.767	0.279	123.314
Max Mx	2	6	80.14	0.109	-3.22
Min Mx	348	13	-214.767	0.279	123.314
Max My	346	13	-185.128	0.858	85.299
Min My	5	13	-125.47	-0.936	144.557
Max Mz	235	13	-166.446	-0.114	169.062
Min Mz	116	6	3.211	-0.047	-80.26

Node displacement

	Beam	L/C	Node	Fx N	Fy N	Fz N	Mx KNm	My KNm	Mz KNm
Max Fx	289	6	118	1.73E+07	-257.806	1520.339	-0.02	-0.936	-0.509
Min Fx	89	5	1	-5.57E+05	23768.27	-32054	0.142	155.856	114.721
Max Fy	465	6	321	-3234.61	4.78E+05	146.094	1.293	-0.398	636.514
Min Fy	476	6	335	-13515.1	-4.94E+05	30.782	-1.292	0.112	656.388
Max Fz	196	6	108	5.13E+05	-3480.17	2.06E+05	-0.269	-284.06	-5.172
Min Fz	790	6	453	5.26E+05	-683.724	-2.07E+05	-0.184	284.248	-1.846
Max Mx	679	6	456	1.32E+05	1.74E+05	843.642	4.914	-2.361	249.829
Min Mx	1118	6	341	1.33E+05	53679.7	-864.98	-4.826	1.963	-53.655
Max My	196	6	113	4.84E+05	-3480.17	2.06E+05	-0.269	396.629	6.313
Min My	790	6	458	4.97E+05	-683.724	-2.07E+05	-0.184	-398.97	0.411
Max Mz	476	6	335	-13515.1	-4.94E+05	30.782	-1.292	0.112	656.388
Min Mz	396	6	230	4.50E+05	2.01E+05	75229.86	0.464	139.331	-388.7

Maximum shear force and bending moment

5. DESIGN PARAMETERS

Beam Design

Design results

M30 Fe415 (Main) Fe415 (Sec.)

LENGTH: 5000.0 mm SIZE: 300.0 mm X 500.0 mm COVER: 25.0 mm

SUMMARY OF REINF. AREA (Sq.mm)

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	536.23 (Sq. mm)	0.00 (Sq. mm)	288.80 (Sq. mm)	367.68 (Sq. mm)	1620.08 (Sq. mm)
BOTTOM REINF.	773.05 (Sq. mm)	486.58 (Sq. mm)	307.68 (Sq. mm)	288.80 (Sq. mm)	0.00 (Sq. mm)

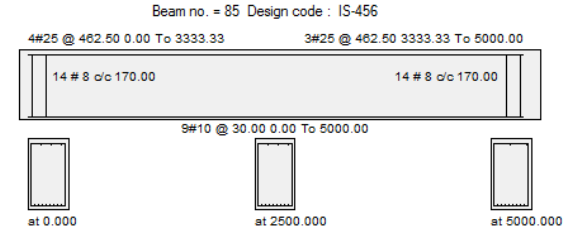
SUMMARY OF PROVIDED REINF. AREA

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	3-16ί 1 layer(s)	2-16ί 1 layer(s)	3-16ί 1 layer(s)	3-16ί 1 layer(s)	9-16ί 2 layer(s)
BOTTOM	10-10ί	7-10ί	4-10ί	4-10ί	2-10ί

SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT

SHEAR DESIGN RESULTS AT 715.0 mm AWAY FROM START SUPPORT
VY = 73.36 MX = -0.22 LD= 8
Provide 2 Legged 8ί @ 170 mm c/c

SHEAR DESIGN RESULTS AT 715.0 mm AWAY FROM END SUPPORT
VY = -127.59 MX = -0.21 LD= 9
Provide 2 Legged 8ί @ 170 mm c/c



Design Load

Mz Kn Met	Dist. Met	Load
97.99	3.3	6
-253.66	0	6
-0.5	2.1	4

Design Parameter

Fy(Mpa)	415
Fc(Mpa)	25
Depth(m)	0.5
Width(m)	0.300000011
Length(m)	5

Column Design

Design results

M25 Fe415 (Main) Fe415 (Sec.)

Length: 3300.0 mm Cross Section: 500.0 mm × 500.0 mm Cover: 40.0 mm

Guiding Load Case: 6

End Joint: 345 Short Column

Reqd. Steel Area : 7592.13 mm^2

Reqd. Concrete Area: 242407.88 mm^2

Main Reinforcement: Provide 16 - 25 Dia. (3.14%, 7853.98 Sq.mm.)

(Equally Distributed)

Tie Reinforcement: Provide 8 mm Dia.

Rectangular Ties @ 300 mm C/C

Section Capacity Based On Reinforcement Required (KN-Met)

P_{uz}: 5090.14

M_{uz1}: 522.47

M_{uy1}: 522.47

Interaction Ratio: 1.00 (As Per Cl. 39.6, Is456:2000)

Section Capacity Based On Reinforcement Provided (KN-Met)

Worst Load Case: 6

End Joint: 345

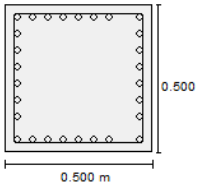
P_{uz}: 5168.69

M_{uz}: 534.14

M_{uy}: 534.14

Ir: 0.98

Beam no. = 747 Design code : IS-456

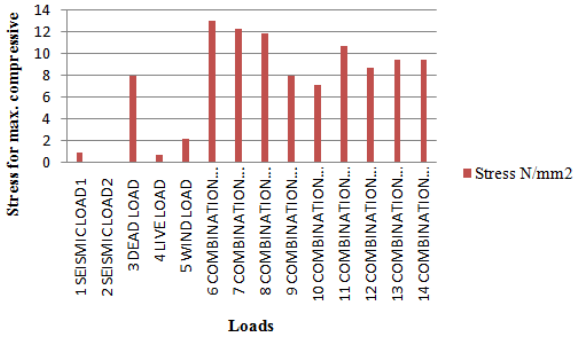


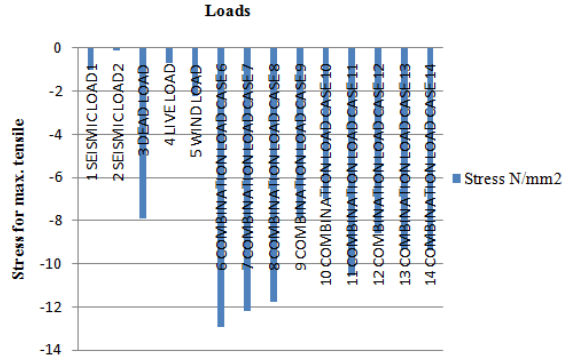
Design Load	
Load	6
Location	End 1
Pu(Kns)	4488.58
Mz(Kns-Mt)	147.06
My(Kns-Mt)	142.27

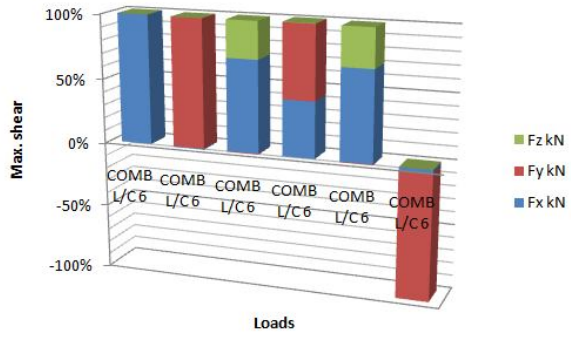
Design Parameter	
Fy(Mpa)	415
Fc(Mpa)	25
As Reqd(mm²)	8587
As (%)	3.51
Bar Size	20
Bar No	28

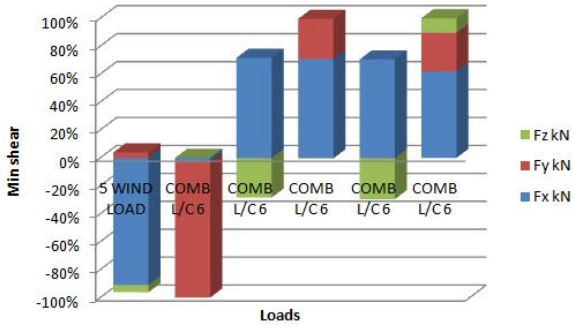
Applied Loads - Service Stress Level					
LC	Axial (kN)	Shear X (kN)	Shear Z (kN)	Moment X (KNm)	Moment Z (KNm)
1	-229.497	15.299	1.451	7.071	-75.143
2	-209.432	1.335	12.896	63.839	-6.447
3	1320.68	-2.571	-2.566	-3.229	3.254
4	3267.52	-14.659	-14.595	-19.463	19.656
5	507.174	-2.106	-2.098	-2.618	2.638
101	6863.81	53.706	61.88	420.666	-378.49
102	5491.05	42.965	49.504	336.533	-302.79
250	4656.45	-2.702	-4.913	45.6	-56.042

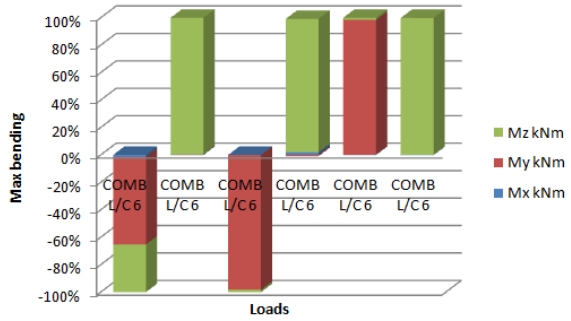
6. RESULTS

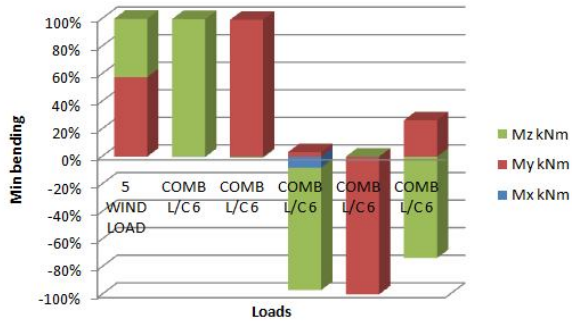












7. CONCLUSION

The response of a residential building beneath wind and seismic load as per IS codes of observe is studied. Seismic analysis is employed for analysis of

a G+21-storey RCC high rise building as per IS 1893(Part1):2002 and IS 875(Part3):1987codes severally. The building is sculpturesque as 3D house frame exploitation STAAD.Pro software. It's discovered that the forces found from present analysis in beams and columns exploitation STAAD.Pro. Safety of the building is checked against allowable Limits prescribed for shear force, bending moment, stress and displacements in codes of practices and different references in literature. I have also compared the analysis and design by the "STRUDS" software.

While planning, a number of the beams and column sections, the limit on most proportion of reinforcement within the member is exceptional the most proportion of reinforcement within the member. To satisfy these limits, it's recommended to extend the grade of the concrete from M25 to M30 and therefore the cross sections of the columns and beams are ought to be enlarged.

References

[1] Divya kmath, K. Vandana Reddy, Analysis and design of reinforced concrete structures-A G+5 building model, mini project report, Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad, India, 2012

[2] Soil and Foundation hand book, State Materials Office Gainesville, Florida, 2004

[3] IS: 875 (Part 1), Part 1: Dead Loads--Unit Weights of Building Materials (Second revision), Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures, Bureau of Indian Standards, New Delhi, 2000.

[4] IS: 875 (Part 2), Part 2: imposed loads (Second revision), Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures, Bureau of Indian Standards, New Delhi, 1987.

[5] IS: 13920, Ductile detailing of reinforced concrete structures subjected to seismic forces, Bureau of Indian Standards, New Delhi, 1987.

[6] IS: 456 (Fourth Revision), Plain and Reinforced Concrete - Indian Standard code of practice, Bureau of Indian Standards, New Delhi, 2000.

[7] IS:SP19-1980, Design Aids of Reinforced Concrete to IS:456-1978

[8] D. Baldev, D. R. Prajapati, "Panchal study of seismic and wind effect on multi storey rcc., steel and composite building,"

[9] A. S. Patil and P. D. Kumbhar, "Time history analysis of multistoried rcc buildings for different seismic intensities,"

[10] Dj. Ladjinovic, A. Raseta, A. Radujkovic & R. Folic, "Comparison of Structural Models for Seismic Analysis of Multi-Storey Frame Buildings,"