Research Article Impact Factor: 4.226 ISSN: 2319-507X
Mehul R. Rathi, IJPRET, 2016; Volume 4 (9): 528-537 IJPRET

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

ANALYSIS FOR (G+10) BUILDING BY CONSIDERING SESMIC AND WIND EFFECT

MEHUL R. RATHI, NIKHIL AGRAWAL[1]

1. Student, Department of Civil Engineering, Ramdeobaba College of Engineering and Management, Nagpur-440013.
2. Faculty, Department of Civil Engineering, Ramdeobaba College of Engineering and Management, Nagpur-440013.

Accepted Date: 15/03/2016; Published Date: 01/05/2016

Abstract: Nowadays, multi-storeyed buildings are collapsing and the only reason for such happening is the improper base foundation. Hence to build a balanced and safe structure it is important to have basic knowledge of seismic and wind analysis. The basic objective of this paper is to study seismic analysis for a G+10 building located at Zone V and wind analysis for a G+10 building located at Guwahati for wind speed of 50m/s. This study is based on STADD.PRO software. From the analysis and design it is observed that there is no need to analyse the structure by both the method (seismic and wind) simultaneously. During the time of earthquake there is rarest possibility of acting wind waves on the same structure.

Keywords: Seismic analysis, wind analysis, equivalent static analysis, response spectrum analysis.

Corresponding Author: MR. MEHUL R. RATHI

Access Online On:

www.ijpret.com

How to Cite This Article:

Mehul R. Rathi, IJPRET, 2016; Volume 4 (9): 528-537

PAPER-QR CODE

INTRODUCTION

The seismic and wind analysis and design of buildings has primarily focused on reducing the risk of loss of life. Based on the historic performance of buildings and their deficiencies, Building Codes have developed provisions in order to prevent prostration due to seismic and wind pressure under the most exquisite earthquake which are generally more prone to occur at a site during the designed life of a structure. These provisions are based on the concept that the successful performance of buildings in seismic prone areas depends on a combination of strength and ductility, whereas the need for ductility reduces substantially in regions of low seismicity.

Differentiating forces due to wind and earthquakes is vital. Distortions induced by the motion of the ground on which the structure rests leads to earthquake. The properties of the structure and its foundation, also the character of the ground motion provokes the magnitude and distribution of forces and displacements. There is a basic difference in the manner in which wind and seismic forces are induced in a structure besides the fact of them being essentially dynamic. Wind loads that are applied as external loads, are proportional to the exposed surface of a structure, whereas the earthquake forces are foremost internal forces which are caused due to distortion produced by the inertial resistance of the structure to earthquake motions. High rise building are prone to various issues caused due to windstorms. Hence while designing buildings which can deal with wind problem, we have to take into account the surrounding too. The sway caused by wind at the top of the building are of greater concern to those occupying the top floors. Nature of wind in atmosphere, wind speed is directly proportional to height. The variation in height relies on the atmospheric and terrain conditions.

METHODS OF ANALYSIS:

A) Seismic Analysis: IS 1893:2002 (Part 1)

Seismic Analysis is nothing but an Earthquake analysis which is based on IS 1893:2002(Part 1). In this seismic analysis method, we use different load combinations which is acting according to seismic wave transformation like X and Z direction. In this case we consider Zone -V (Guwahati) which resides seismically active area according to IS 1893:2002

B) Wind Analysis: IS 875: 1987 (Part 3)

In this wind analysis method we use different load combinations which is acting according to wind wave transformation like X and Z direction. Direction is considered according to exposure factor related to our structure location. In this case also same region we have considered for wind analysis having wind speed 50m/s based on IS 875: 1987 (Part 3)

Basic objective of earthquake and wind-resistant design is to provide a structure with features, which will enable it to efficiently deal with seismic and wind effects.

Basic objective of earthquake and wind-resistant design is to provide a structure with features, which will enable it to efficiently deal with seismic and wind effects.

MODAL GENERATION: Here we have considered G+10 building, having a plan of 20x16m, foundation 1.2m and storey height as 3.1m. According to IS-875 Part 1 and Part 2, we have assigned dead load, live load and self-weight to the structure. As per IS-875 Part 3, wind intensity at different locations and at different height are assigned to the structure. Response Reduction Factor (Special Moment Resisting Frame=5). Considering Importance Factor as 1.5 and type of RC Frame Structure as 1 and Damping Ratio of 5% and medium soil in particular.

Type of structure	Residential Building (G+10)
Location	Guwahati
Seismic zone	V
Wind speed	50m/s
Foundation Level To Ground Level	1.2m
Storey Height	3.1m
External Wall	230mm
Internal wall	115mm
Size of Column	C1= 350x600 C2= 300x600
Size of Beam	B1= 300x450
Depth of Slab	120mm
Grade of Concrete	M25

Grade of Steel	Fe415

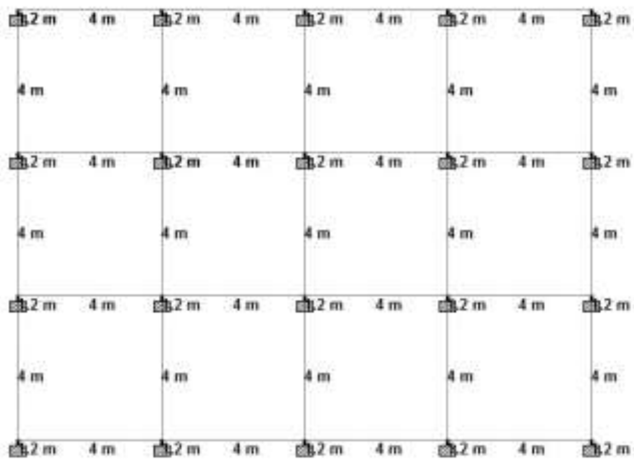

Fig1. Column Position

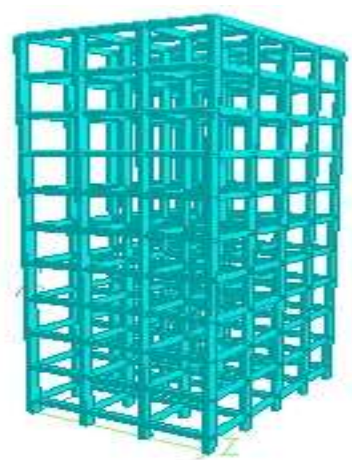

Fig2. 3D Structure

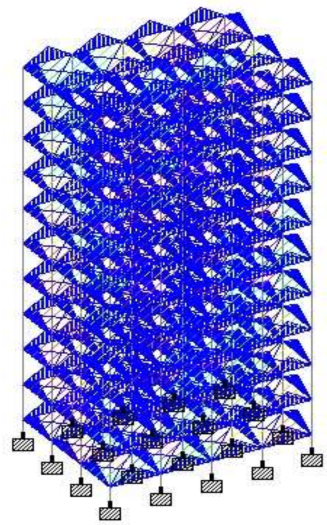

Fig3. Live Load

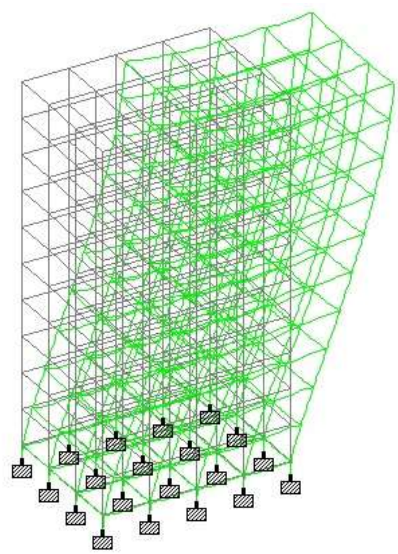

Fig 4. Deflected Pattern

Results for Seismic Analysis:

Column Size: 350x600mm (Exterior Column)

Sr. No.	Storey Height (m)	Displacement (mm)	Axial Force (kN)	Bending Moment (kN-m)		Steel, Ast (mm²)
1	1.2	0.397	**2.40E+03**	144.565	-149.417	3024
2	4.3	3.794	2.20E+03	**127.092**	**-160.801**	**3831**
3	7.4	8.254	1.99E+03	92.108	-111.196	2352
4	10.5	12.924	1.76E+03	99.396	-101.665	2016
5	13.6	17.553	1.52E+03	101.338	-96.321	1848
6	16.7	22.005	1.28E+03	101.25	-90.898	1680
7	19.8	26.156	1.05E+03	99.508	-83.548	1680
8	22.9	29.868	8.23E+02	95.846	-73.664	1680
9	26	32.993	6.04E+02	89.521	-60.961	1680
10	29.1	35.384	4.13E+02	78.02	-46.055	1680
11	32.2	**36.987**	2.18E+02	86.735	-44.882	1781

Column Size: 300x600mm (Interior Column)

Sr. No.	Storey Height (m)	Displacement (mm)	Axial Force (kN)	Bending Moment (kN-m)		Steel, Ast (mm^2)
1	1.2	0.404	**3.36E+03**	135.454	-135.454	5760
2	4.3	3.856	2.48E+03	**160.847**	**-160.847**	**5760**
3	7.4	8.342	2.21E+03	147.483	-147.483	5328
4	10.5	13.05	2.42E+03	141.906	-141.96	4728
5	13.6	17.73	2.11E+03	140.375	-140.375	4216
6	16.7	22.248	1.88E+03	137.283	-137.283	3521
7	19.8	26.478	1.50E+03	130.753	-130.753	2774
8	22.9	30.279	1.20E+03	120.357	120.357	2005
9	26	33.493	9.01E+02	105.531	-105.531	1606
10	29.1	35.963	6.04E+02	83.98	-83.98	1440
11	32.2	**37.595**	3.10E+02	63.675	-63.675	1440

Results for Wind Analysis:

Column Size: 350x600mm (Exterior Column)

Sr. No.	Storey Height (m)	Displacement (mm)	Axial Force (kN)	Bending (kN-m)	Moment	Steel, Ast (mm^2)
1	1.2	0.776	**2.01E+03**	75.465	-76.655	4105
2	4.3	6.782	1.87E+03	**55.859**	**-89.899**	**4105**
3	7.4	13.384	1.7E+03	60.001	-31.083	1680
4	10.5	19.458	1.52E+03	61.369	-53.805	1680
5	13.6	24.844	1.35E+03	59.637	-49.556	1680
6	16.7	29.498	1.17E+03	56.973	-46.166	1680
7	19.8	33.396	9.8E+02	53.901	-42.840	1680
8	22.9	36.526	7.9E+02	50.523	-39.425	1680
9	26	38.888	6.1E+02	46.811	-39.374	1680
10	29.1	40.467	4.1E+02	39.824	-40.341	1680
11	32.2	**41.451**	2.2E+02	78.203	-45.882	1680

Column Size: 300x600mm (Interior Column)

Sr. No.	Storey Height (m)	Displacement (mm)	Axial Force (kN)	Bending (kN-m)	Moment	Steel, Ast (mm^2)
1	1.2	1.022	**3.36E+003**	74.550	-74.550	**5459**
2	4.3	7.706	3.05E+003	**84.507**	**-84.507**	4868
3	7.4	14.783	2.73E+003	67.127	-67.127	4237
4	10.5	21.140	2.42E+003	62.770	-62.770	3024
5	13.6	26.701	2.11E+003	55.988	-55.988	1872
6	16.7	31.462	1.8E+003	48.595	-48.595	1440
7	19.8	35.424	1.5E+003	41.040	-41.040	1440
8	22.9	38.581	1.2E+003	33.396	-33.396	1440
9	26	40.926	901.212	25.684	-25.84	1440
10	29.1	42.450	604.159	17.299	-17.299	1440
11	32.2	**43.271**	309.098	10.522	-10.522	1440

CONCLUSION:

Exterior Column:

In seismic analysis, value of maximum displacement is 36.987mm. Similarly, for wind analysis maximum displacement is 41.451mm.

In seismic analysis, value of maximum axial force is 2400kN. Similarly, for wind analysis maximum axial force is 2001kN.

In seismic analysis, value of maximum bending moment at top is 127.092kN-m and at bottom is 160.801kN-m. Similarly, for wind analysis maximum bending moment at top is 55.859kN-m and at bottom is 89.899kN-m.

In seismic analysis, value of maximum steel is 3831mm2. Similarly, for wind analysis maximum steel is 4105mm2

Interior Column:

In seismic analysis, value of maximum displacement is 37.595mm. Similarly, for wind analysis maximum displacement is 43.271mm.

In seismic analysis, value of maximum axial force is 3360kN. Similarly, for wind analysis maximum axial force is 3360kN.

In seismic analysis, value of maximum bending moment at top and bottom is 160.847kN-m. Similarly, for wind analysis maximum bending moment at top and bottom is 84.547kN-m.

In seismic analysis, value of maximum steel is 5760mm2. Similarly, for wind analysis maximum steel is 5459mm2

From the above results, it shows that during the time of seismic and wind, there is a maximum displacement at top storey level especially in case of wind effect; and also there is a maximum axial force at foundation level. From the result of bending moment, maximum steel is found at first storey level. And therefore it should be concluded that, a seismic zone V in which a city Guwahati is located; is having a wind speed 50m/s, for which seismic analysis is more effective as compared to wind analysis.

REFERENCES:

1. E. Pavan Kumar, A. Naresh, M. Nagajyothi, M. Rajasekhar "Earthquake Analysis of Multi Storied Residential Building - A Case Study"
2. Nikhil Agrawal, Prof.P.B Kulkarni, Pooja Raut "Analysis of Masonry Infilled R. C. Frame with & without Opening Including Soft Storey by using "Equivalent Diagonal Strut Method"- "International Journal of Scientific and Research Publication"
3. Mohit Sharma, Dr. Savita Maru, "IOSR Journal of Mechanical and Civil Engineering"
4. Pooja Raut, Nikhil Agrawal, Prof.P.B Kulkarni, "Analysis of Masonry Infilled Frame with and without Different Percentage of Opening "
5. Kiyoshi Muto "Earthquake resistant design of 36 storied Kasumigaseki Building"
6. Vipin V Halde , Aditi H. Deshmukh "Effect of Soft Storey on Structural Response of High Rise Building"
7. Manju G "Dynamic Analysis of Infills on R.C Framed Structures"
8. Anupam Rajmani, Prof Priyabrata Guha, "Analysis of Wind & Earthquake Load for Different Shapes of High Rise Building"
9. IS: 456-2000, "Indian Standard Plain Reinforced Concrete Code of Practice"
10. IS: 875-1987 (part-1) for Dead Loads, code of practice of Design loads (other than earthquake) for buildings and structures.
11. IS: 875-1987 (part-2) for Imposed Loads, code of practice of Design loads (other than earthquake) for buildings and structures.
12. IS: 875-1987 (part-3) for Wind Loads, code of practice of Design loads (other than earthquake) for buildings and structures.
13. "Criteria for Earthquake Resistant Design of Structures", Part 1, Bureau of Indian Standards, IS: 1893-2002, India.
14. "Ductile detailing of reinforced concrete structure subjected to seismic forces", IS: 13920-1993.