Comparative Study of Analysis for Horizontal Forces on Multistoried Infrastructure

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***Abstract*—This Experiment is going to compare a G+9 building structure for BHUJ and BHUBANESWAR cities. Bhuj and Bhubaneswar are in high seismic zone. We analyzed the horizontal forces on building structure in those cities by using Staad pro software. We tested the building structure under the earthquake and wind load for BHUJ and BHUBANESWAR having same materials and dimensions for beams, columns and slabs. The grade of concrete, grade of steel for $F_y$main and $F_y$sec are same for for member of structure. The seismic zone and wind speed are different FOR BHUJ and BHUBANESWAR. In this comparative study, we calculated the max Axial force, Max bending moment and Max shear force for the Beam No.60, column No.66 and column No.1271 of structure for BHUJ and BHUBANESWER cities by using Staad pro. We compared max axial force, max bending moment, max shear force and draw a graph. It is found that Max axial force, Max shear force and Max bending moment are for columns and beam of building structure for BHUJ AND BHUBANESWAR.**

Keywords*—Seismic waves(earthquake), Staad pro,RCC framed structure,IS codes.

I. INTRODUCTION

The horizontal forces are generated in the building due to earth quake and wind load. The Earthquake is nature hazard, it cause terribly damage irreparably to the building structure, building members as well as human beings and human life. Earthquakes are generated due to shaking of the surface of the Earth, resulting from the sudden discharge of energy in the Earth's crust that generates seismic waves. Wind speed, frequency and direction will regulate the building design including requirements of bracing, roof and wall selection, Building entrance locations, size of window and provision of shelter for outdoor spaces. Staad pro's full form is structural aided analysis and design. It was invented by research engineers international in Yorba Linda, CA later it was sold to Bentley in late 2015[1]. Staad Pro is an analysis and design software package for the structural engineers used in performing the analysis and design of wide variety of type of structure. Staad.pro may be utilized for analysis and design practically all types of structure- building, tower, bridge etc.

II. METHODOLOGY AND PROBLEM FORMULATION

Comparative study of earthquake and wind behavior on multistoried structures building frame in BHUJ AND BHUBANESWER under the earthquake effect as per 1893-2002(Part-IV) and Is 875(PART III) static analysis, a comparison of analysis results in terms of maximum bending oment, maximum axial force, maximum shear force has been carried out.[3]

Data assumed for analysis of earthquake effect and wind load effects on structures are:

TABLE I: Preliminary data's for the structure at Bhubaneshwar

1	Type of structure	Multi-storey rigid jointed RC moment resisting frame
2	City	Bhubaneswar
3	Number of stories	10(G-9)
4	Floor Height	3m
5	Materials	Concrete (M30) and RC (Fe415)
6	Size of columns	0.50m*0.45m
7	Size of beams	0.50m*0.45m
8	Specific Weight of RCC	25KN/m2
9	Type of soil	Soft soil site
10	Seismic zone	III
11	Z	0.16
12	Response reduction	5
13	Importance Factor	1.5
14	Wind Speed	50 m/s

The above table represents the values of the basic and main parameters upon which the horizontal forces generate according to the Seismic activities at Bhubaneshwar.

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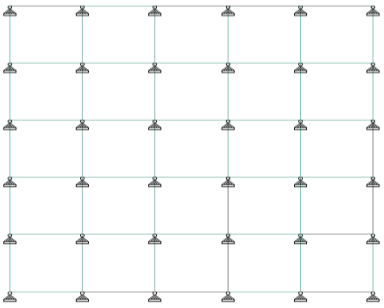

Fig.1: Plan of structure

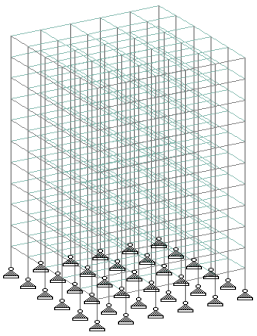

Fig.2: Elevation of structure

TABLE II: Main parameters

1	Type of structure	Multi-storey rigid jointed RC moment resisting frame
2	City	Bhuj
3	Number of stories	10(G+9)
4	Floor Height	3m
4	Materials	Concrete (M30) and RC (Fe415)
5	Size of columns	0.50m*0.45m
6	Size of beams	0.50m*0.45m
7	Depth of slab	0.25m
8	Specific Weight of RCC	25 KN/m2
9	Type of soil	Soft soil site
10	Seismic zone	IV
11	Wind speed	50 m/s
12	Z	0.36
13	Response reduction factor	5
14	Importance Factor	1.5

In this research paper, 3-D analysis had been carried out on the R.C.C. frame of G+9 RC building in BHUJ and BHUBNESAR by the help of staad pro software. The frame was assumed to be designed for institutional building with five and five bays in X and Z direction, diemsion of plan 15m*15m and typical storey height of 3m was considered as shown in fig. 1 and 2. The 3-D view of the buildng which was moulded in staad pro. In fig.3 the dimension of beam and coloumn was obtained by optimization and the perlminary data which was asssumed for the investigation was presented in table 1and table 2[3]

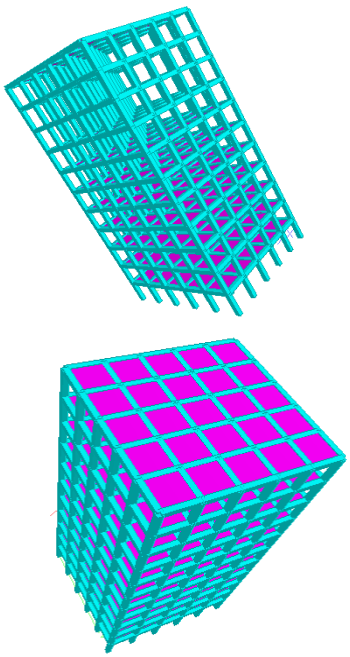

Fig.3: 3D rendered view of the building from staad pro

III. EQUATIION AND FORMULA USED

$$Q_i = V_B \frac{W_i h_i^2}{\sum_{j=1}^{n} W_j h_j^2}$$

Q_i = Design Lateral force at floor,

Analysis and design of building structure

The explained 3D building model is analyzed using equivalent static method. The building models are then analyzed by the software Staad pro. Different parameters such as deflection, story drift, shear force and bending moment are studied for the model seismic codes are unique to a particular region of country in India. Indian standard criteria for earthquake resistant design of structure is 1893(part IV):2005 is the main code that provide outline for calculating seismic force. Wind forces are calculated by using IS 875(PART 3)[4]

IV. RESULT AND DISCUSSON

TABLE III: Comparison of RCC structure under the effect of earthquake load

Factor	Beam 60 of structure in BHUJ	Beam 60 of structure in BHUBANESWAR
Max axial force Fx	15.897KN	14.387KN
Max shear force Fz	0.232KN	.209KN
Max bending moment(Y-axis)	.709KNm	.646KNm
Max bending moment(z-axis)	245.627KNm	227.745KNm

The tables indicate the effect of RCC structure under the varying and affecting parameters like Wind load, Earthquake load and wind speed. (Beam type is also indicated)

TABLE IV. Comparison of RCC structure under the effect of wind speed

Factor	Beam 60 of structure in BHUJ	Beam 60 of structure in BHUBNESWAR
Max axial force Fx	N/A	N/A
Max shear force Fy	27.74KN	22.478KN
Max bending moment(Y-axis)	.098KNm	.070KNm
Max bending moment(z-axis)	35.109KNm	48.493KNm

TABLE V: Comparison of RCC structure under the effect of wind load

Factor	Column 66 of structure in BHUJ	Column 66 of structure in BHUBANESWAR
Max axial force Fx	1994.090	1994.090Kn
Max shear force Fy	13.783KN	13.783KN
Max bending moment(Y-axis)	0.0KNm	0.0KNm
Max bending moment(z-axis)	N/A	N/A

TABLE VI. Comparison of RCC structure under the effect of earthquake load

Factor	Column 66 of structure in BHUJ	Column 66 of structure in BHUBANESWAR
Max axial force Fx	2892.704KN	2813.844KN
Max shear force Fy	96.985KN	89.422KN
Max bending moment(Y-axis)	N/A	N/A
Max bending moment(z-axis)	0KNm	0KNm

TABLE VII: Comparison of RCC structure under the effect of wind speed

Factor	column 1271 of structure in BHUJ	Column1271of structure in BHUBNESAR
Max axial force Fx	167.505KN	167.505KN
Max shear force Fy	N/A	N/A
Max bending moment(Y-axis)	45.897KNm	45.897KNm
Max bending moment(z-axis)	56.662KNm	56.662KNm

The tables indicate the effect of RCC structure under the varying and affecting parameters like Wind load, Earthquake load and wind speed.

V. CONCLUSION

Analysis and design result of G+9 storied building structure for BHUJ AND BHUBNESWER under the effect of horizontal forces. The comparison of result of Structures for BHUJ and BHUBNESWERS shows that the wind load effect on the building structure is likely same. The earthquake effect on the building structure varies when height of building changes

REFERENCE

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[2] IS: 456(2000),"Indian standard code of practice for plan and reinforced concrete (fourth revision)". Bureau of IS (BIS), New Delhi,

[3] IS 1893-2002,"Indian standard code of practice for seismic load"

[4] IS 875(1987-Part 3),"Indian standard code of practice for wind loads". Bureau of IS (BIS), New Delhi,