IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 38-42

Seismic Analysis of Hostel Buildingunder Various Earthquakes Zones in India

Prof P. D. Hiwase[1], Miss Shreya Umredkar [2], Mr Anuj Shiwal[3],
Mr Meet Bhagat [4], Mr Aditya Tripathi [5]
Assistant professor [1], B.E. Final Year Students [2], [3], [4], [5]
Department of Civil Engineering Shri Ramdeobaba College of Engineering and Management, NagpurIndia

Abstract: *In this rapidly expanding and developing world, new structures are being constructed at a high rate and, in this scenario, it is very important to analyse, estimate and evaluate them before being constructed in the field. Our research focuses on the analysis of Hostel building under static loading and also under the effect of lateral forces that is considering seismic forces in various Zones in India. The analysis has been carried out using Staad-Pro software. The building has been modelled as framed structure in Staad pro and all relevant loading have been applied using IS 875 –Part 2 and Seismic loading has been considered with reference to IS 1893-2016. Analysis Sheets have been prepared according to relevant IS codes and similarly all structural elements have been analysed and compared considering all relevant code books with verifying the results with some manual calculations.*

I. Introduction

Earthquake engineering plays an important role in today's infrastructure design process.An earthquake might have a very low possibility of occurrence in some region, but the probability should not be neglected when a structure is constructed, because even if there is one shock due to Earthquake in the buildings life it can be a risk to the resident of the building.

As the construction of multi-storeyed has increased in the recent years and the number of occupants in a building has being increasing, Structural designers have been given more importance to Earthquake induced loads[seismic loads] for designing a building along with taking into consideration the Dead,Live and Wind loads[static loads].

The analysis consists of G+4 Hostel building. The ground floor of building consists of 18 rooms, 8 bathrooms, 8 W.C, 1 kitchen and 1 mess. The floor to floor distance is 3.6m. In this paper we have analysed the effect of earthquake on the hostel building on different seismic zones of India and their effect has been compared & studied. There are many classical methods to solve analysis problem, and with time passing new software are also coming into picture. Here in this paper work is based on software named "STAAD. Pro

Objectives

1. Ensure safety of building against Seismic forces.
2. Studying various output of seismic behaviour in different zone.
3. Comparing various seismic parameters of hostel building under different seismic zones of India.

Method Of Analysis

The structural analysis involves the determination of Axial Forces, Shear Forces, Bending Moment, Earthquake Forces in X and Z direction, for these forces under external loading cases in various earthquake zones in India. The different approaches for analysis are given below,

1. Elastic analysis based on elastic theory
2. Limit analysis based on plastic theory or ultimate load theory
3. Seismic analysis based on IS 1893:2016

In this project, Static Analysis as well as Seismic Analysis is adopted. Static analysis deals with the study of strength and behaviour of members under various load combinations of Dead Load, Live Load. Seismic Analysis involves behaviour of various members of building under various earthquake zones in India.

Design Requirements

It can be defined as methodology in civil engineering that is used for determining safe and economical specifications for a structure which includes calculating /estimating amount of steel, concrete and sizes of different structural member carrying load, to ascertain that a planned and designed structure will be sufficiently stable and strong to carry its intended load during its life time.

The design of the structure must satisfy three basic criteria:

Criteria of Serviceability: To safeguard satisfactorily performance under service load conditions which contains deflection, crack width, vibration within permissible limit.
Criteria of Strength: To provide resistance against stresses induced due to loading in various structural components of the building.
Criteria of Stability: To provide safety against overturning, buckling and sliding of a structure or a part of it under action of load.

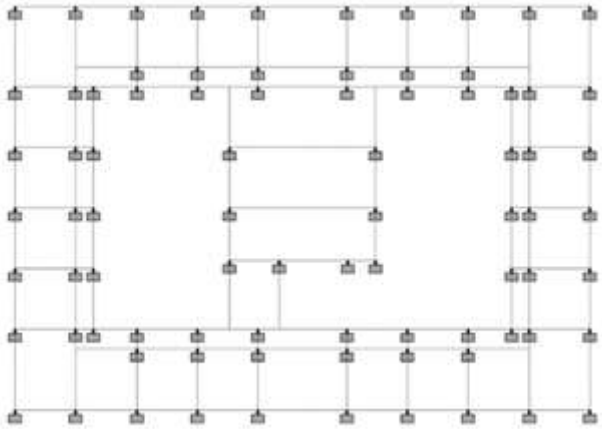

Fig: Top view of model

Loads And Calculations
The various loads involved in structure which requires to be considered are as follows:
1. Dead Load
2. Live Load
3. Seismic Load
4. Wind Load
5. Snow Load

Dead Load (Is 875: (Part 1)):
Dead Loads are the loads which does not change their position, magnitude. It involves wall load, member loading, slab loading etc.
While calculating Dead Load, the unit weight of considered are as follows:
1. Brick Masonry: 20 KN/m3
2. Brick Masonry with Plaster: 22 KN/m3
3. Concrete : 25 KN/m3
4. Floor Finishes : 1 KN/m3

Live Load (Is 875:1987 (Part 2)):
Live Loads are the loads which change their magnitude and position according to different cases. The Live Load for Hostel building are as follows:
1. For Living Room, Bed Room and Dormitories- 2 KN/m2
2. Kitchens and Laundries, Corridors – 3 KN/m2
3. Store Room – 5 KN/m2
4. Dining Room – 4 KN/m2
5. Baths and Toilets – 2 KN/m2

SEISMIC LOAD (IS 1893: 2016)
Seismic loads are applicable as per various Earthquake Zones such as Zone 2, Zone 3, Zone 4, and Zone 5. As per the Zones, various cities fall under different zones of earthquake. The RC structure is constructed on medium rock soil. The seismic analysis is done in SPECIAL MOMENT RESISTING FRAME. The factors for various zones are as follows:
1. Zone 2- 0.1

2. Zone 3- 0.16
3. Zone 4- 0.24
4. Zone 5- 0.36

Load Combinations Used:

1. Dead Load + Live Load , Factor- 1
2. 1.5(Dead Load + Live Load), Factor- 1.5
3. Dead Load + 0.25 Live load, Factor- 1, 0.25 respectively (It is only considered for earthquake loads)

II. Loading Calculation:

DEAD LOAD:

1. On Plinth:

Assumed dimensions
Required Floor Height- 3.6 m
Width of wall – 230 mm
Width of Partition wall – 115 mm
Beam Dimension – 230 x 500 mm
Column dimensions – 230 x 500 mm
Wall Load (Outer): 3.1 x 22 x 0.23 =15.686 KN/m
Wall Load (Partition): 3.1 x 22 x .115=7.843 KN/m
Wall Load (Parapet): 1.2 x 22 x 0.115= 3.036 KN/m

2. Roof Slab:

Depth of slab is decided by ratio of span to L/d ratio and modification factor plus half of diameter of bar and clear cover.
Modification factor is taken for IS 456:2000
Slab Load: (0.15 x 25) + 1 = 4.75 KN/m2 (Floor Finish- 1 KN/m3)
Corridor slab load: (0.135 x 25) + 1 = 4.375 KN/m2

3. Sunk Load:

Sunk Slab are slab which are casted at certain depth below normal floor level for placing of pipes and utility ducts of sanitary system.

For Brick bat coba Filling Depth = 0.3 m
Load =0.3 x 20 = 6 KN
For Kitchen Washing Area
Sunk Depth = 150mm
Load =0.15 x 20 =3KN

4. On Terrace:

Parapet wall Load: 1.2 x 22 x 0.115 = 3.036
Slab Load: (0.15 x 25) + 1 + 2= 6.75 KN/ m2

5. Staircase Load:

Open Naval Staircase is used.
h = (b^2+d^2) ^0.5
Inclined Length Span = (b^2+d^2) ^0.5 + Span of Mid landing
Waist Slab Depth = Span/2 +Diameter/2 + Clear cover of slab
Load = (Depth *25) + 1 [Floor finish =1kn/m2]
Staircase tower Ht. = 2.1 m

Load Combinations

1.	DL+LL	10. 1.5(DL+LL)
2.	DL+EQX	11. 1.5(DL+EQX)
3.	DL-EQX	12. 1.5(DL-EQX)
4.	DL+EQZ	13. 1.5(DL+EQZ)
5.	DL-EQZ	14. 1.5(DL-EQZ)
6.	0.9DL+1.5EQX	15. 1.2(DL+LL+EQX)
7.	0.9DL-1.5EQX	16. 1.2(DL+LL-EQX)
8.	0.9DL+1.5EQZ	17. 1.2(DL+LL+EQZ)
9.	0.9DL-1.5EQZ	18. 1.2(DL+LL-EQZ)

III. Results And Discussion

Considering all the modes, we have compared that the values of deflection, moment and axial forces in beam and column for static loading and seismic loading in all four earthquake zones,

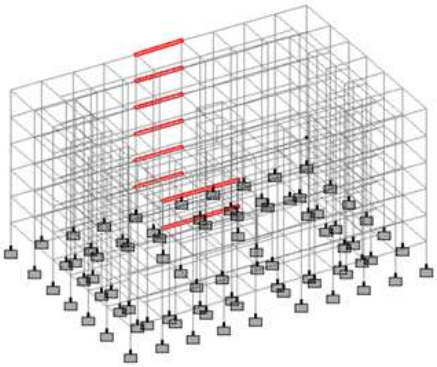

Fig: Beams considered for bending moment & Deflection variation

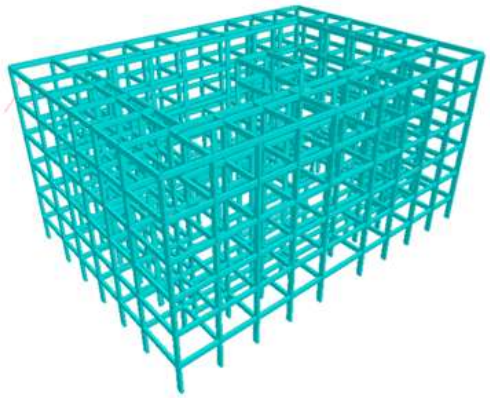

Fig: Rendered View of Model

Variation In Bending Moment

Beam No.	Static	Zone 2	Zone 3	Zone 4	Zone 5
300	**85.1** (DL+LL)	**136.23** 1.5(DL-EQX)	**149.98** 1.5(DL-EQX)	**168.30** 1.5(DL+EQX)	**195.78** 1.5(DL-EQX)
281	**229.12** (DL+LL)	**348.68** 1.5(DL+EQX)	**343.63** 1.5(DL+EQX)	**343.68** 1.5(DL+EQX)	**343.68** 1.5(DL+EQX)

Variation In Deflection

Beam No.	Static	Zone 2	Zone 3	Zone 4	Zone 5
300	**7.89** (DL+LL)	**11.84** 1.5(DL+EQX)	**11.841** 1.5(DL+EQX)	**11.59** 1.5(DL-EQX)	**12.084** 1.5(DL-EQZ)
281	**41.27** (DL+LL)	**44.34** 1.5(DL-EQX)	**46.61** 1.5(DL-EQX)	**61.911** 1.5(DL+EQX)	**61.911** 1.5(DL+EQX)

Variation In Axial Force

Axial force is considered for un-factored load combination

Column No.	Static	Zone 2	Zone 3	Zone 4	Zone 5
562	1280.293	1291.801	1920.425	2045.445	2207.061

IV. Conclusion

From the following tests, we can conclude that,

1. To make our structure safe against seismic loading, we have to increase the percentage of steel.
2. From our results, we can see values of bending moment increases 6% as change in zone as compared to static load case.
3. We can also conclude that, the values of deflection increases 4% as change in earthquake zones as compared to static load cases.
4. As we go on higher side of earthquake zones, the deflection value increase.

V. Future Scope

1. Wind effect is considered for further calculations
2. Number of stories will be increased and analyse the effect of earthquake loading in various earthquake zones in India.

Bibliography

[1]. Arunbabum, Ajishsa R. {May: 2018} "Analysis of multi-storey Building in different seismic zones with different soil conditions". International Journal of Research in Engineering, Science and Technology {IJRESTs} Vol5, no. 05.

[2]. S.Bramha Naidu, P.Anil, VVenkatesh, Y.Vinod, and A.Srikant {March-April: 2018}."Planning, designing and Analysis of Hostel Building". International Journal of Engineering Tread's and application {IJRTA} Volume 5, No.2.

[3]. Pillai.S. Unnikrishna and Menon Devdas -Reinforced concrete design .3rd ed. Tata McGraw Hill Education Private Ltd, New Delhi

[4]. Sarkar, P. Agarwal, R and Menon, D." Design of beam, column joints under Seismic loadings "A review, Journal of structural engineering SERC, Vol.33. No.6. Feb.2007

[5]. 5. BIS-1893, Criteria for Earthquake resistant design of structures-Part-1, General Provisions and Buildings, Bureau of Indian Standards, New Delhi2002
[6]. Jain Sudhir.K.-E. Course on Indian seismic code IS-1893-2002-Part-1 IIT Kanpur
[7]. S.K. DUGGAL," Earthquake Resistant Design of Structures ", Professor Civil Engineering Department, Motilal Nehru National Institute of Technology, Allahabad.
[8]. IS: 1893-2016, Part 1, "Criteria for Earthquake Resistant Design of Structures -General Provisions and Buildings", Bureau of Indian Standards, New Delhi, India.
[9]. IS: 875 (Part 1), "Indian Standard Code of Practice for design loads for building and structures, Dead Loads" Bureau of Indian Standards, New Delhi.
[10]. IS: 875 (Part 2), "Indian Standard Code of Practice for design loads for building and structures, Live Loads" Bureau of Indian Standards, New Delhi.
[11]. IS: 875 (Part 3), "Indian Standard Code of Practice for design loads (Other than earthquake) for building and structures, Wind Loads" Bureau of Indian Standards, New Delhi.
[12]. IS 456: 2000,Plain and Reinforced Concrete - Code of Practice is an Indian Standard code of practice for general structural use of plain and reinforced concrete.