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Comparative Study of Siesmic Behaviour of Multi-Storey RCC building in Different Zones

Ruturaj BapuraoSonawane[1], Proffesor N.P Phadatare[2],

*[1]**Ruturaj BapuraoSonawane**, (M.tech in Structural Engineering)*
Padmabhooshan Vasantrao Dada Patil Institute of Technology Budhgaon,Sangli.
*[2]**Proffesor N.P Phadatare**, (Civil Engineering Department)*
Padmabhooshan Vasantrao Dada Patil Institute of Technology Budhgaon,Sangli.

Abstract -In this research project work, we analyzed the Seismic analysis of RC (G+15) Multi-storey building frame structure in different seismic zone by using Linear Static Methods in a Staad Pro V8i. We considered different soil condition and different parameter like size of column 450x450mm, size of beam 230x450mm, thickness of slab 150mm, height of each floors 3m. The comparative analysis of the building frame in the term of Node displacement, Maximum Shear Force, Maximum Bending Moment, Maximum Axial forces. The comparative analysis results observed that As per the results shows that maximum node displacement, shear force and bending moment in zone V in soft soil while minimum at zone II and hard soil. It means that, of we increased the zones the node displacement is also increased. The results in the term of support reaction shows that zone II, III & IV are same with all type of soils but increased with change the zone from IV to zone V with soft soil. The maximum storey-wise displacement founded in zone V with soft soil and minimum at zone II with hard soil and also shows that if we increased the number of storey, node displacement is also increased.

***Key Words*:**RC Building Frame, Staad Pro., Soil, Zone etc

1.INTRODUCTION-In India, we know that the Earthquakes are most unpredictable and devastating of all-natural disasters and have the potential for causing the greatest injuredamongall the natural hazards. Since Seismic forces or earthquake forces are random in nature and unpredictable. They not only cause great harm in human casualties, but also have a huge economic impact on the affected area. The concern about earthquake hazards has led to an increasing awareness and demand for any structure designed to withstand earthquake forces.When a structure is subjected to ground motions during earthquake, it responds by vibrating and those ground motion causes the structure to shake or vibrate in all the directions which the predominant direction of shaking is horizontal.During an earth quake,the effect in a structure generally initiates at location of the structural weakness present in the building systems which also depends upon the location of seismic zone. High-Rise Reinforced Concrete structures are a special class of structures with their own peculiar characteristics and requirements for analysis and design.

2.Siesmic Effects - It has been seen in past earthquake effects that the building structures zone V and Soft soils are more damage. This force cause damages to building structures, for instance, loss of wealth and life in the building structures and if the force of effects is high it prompts breakdown of the structure. As we know that, In the past years population has been extended and a result of which urban zones and towns have started to make different storey of building. In light of this reason, different structures are being locally seismic zones. Now a days, India has an extensive shoreline forefront which is secured with mountains and slopes, like Various resorts are being produced in uneven zones to give courses of action to guests. The structures in these zones are created on sloping

grounds. In India, a huge part of the rough ranges go under the seismic zone (II, III and IV) which determines its intensity as zone II is low where chances of occurrence of earthquake is low whereas zone V is very severe which means chances of earthquake is very high in this areas. In such case building frail against seismic tremor.

Different Seismic Zone in India: As per IS 1893 Part I.

As per Indian Slandered Code IS 1893:2002, the Vibration and Intensity due to seismic waves are calculated, where the design horizontal seismic coefficient Ah can be calculated by the expression:

Where Z = zone factor given in table 2 in IS 1893:2002

$$A_h = \frac{Z I S_a}{2 R g}$$

Seismic Zone	II	III	IV	V
Intensity	Low	Moderate	Severe	Very Severe
Z	0.1	0.16	0.24	0.36

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OBJECTIVES

- To study the behavior of structure in various seismic zones.
- To study the variations in parameters such as Shear Force, Bending moment and Displacement in all seismic zones as per IS: 1893-2002.
- To compare the structure in two models of H shaped Structure without connecting beams and with the connecting beam.

1. METHODOLOGY - In the recent time, Civil & Structural software's analysis is more effectively used in analysis and design of different civil engineering structures. In this work, we using Staad pro software and analyzed the structure as per IS 1893:2002. The following steps are adopted:

Step-1 Modeling of building frame in Node & Transitional repeat with different type of soils, symmetrical (24.02mX24.02m)G+15 story of 3D frame. Fig. 2.1

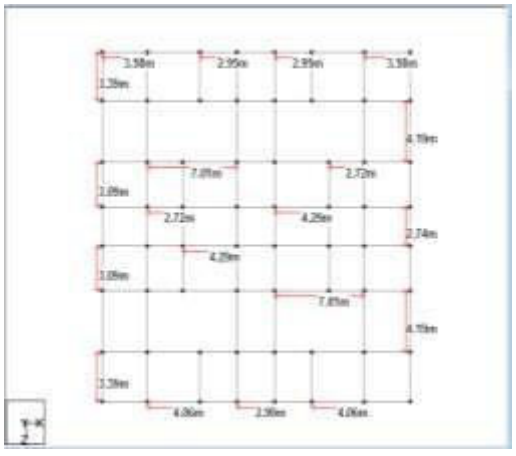


Fig. 2.1 Plan of Building

Step-2 Selection of Building Geometry: Plan of Building 24.02mX24.02m , Size of Columns 450mmX450mm, Size of Beam 230mm X 450mm, Thickness of Slab 150mm; Height of each floor 3.0m, Unit weight of RCC 25KN/m3, Unit weight of bricks 20KN/m3 and Fixed supports.

Step-3 Selection of Seismic Zone and soil conditions As per IS Code.

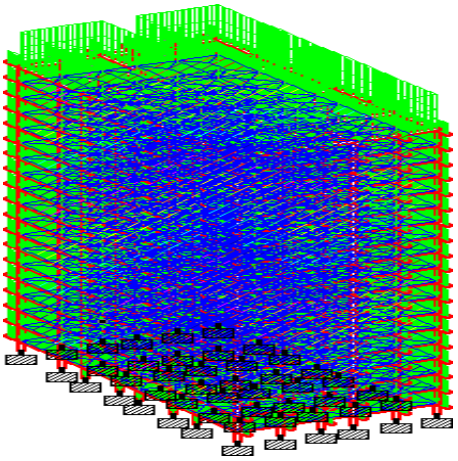
Step-4 Load combinations.

Load case no.	Load cases
1	DL
2	LL
3	EQ,X+
4	EQ,X-
5	E.Q,Z+
6	E.Q,Z-
7	1.5(DL+LL)
8	1.5(DL+E.Q.,X)
9	1.5(DL-E.Q.,X)
10	1.5(DL+E.Q.,Z)
11	1.5 (DL-E.Q.,Z)
12	1.2(DL+LL+E.Q.,X)
13	1.2 (D.L+L.L-E.Q.,X)
14	1.2 (DL+LL+E.Q.,Z)
15	1.2 (DL+LL-E.Q.,Z)

Step-5 Designing of building frames using STAAD.Pro v8i software in 3D rendered view.

Step-6 Analysis considering different types of soil condition providing different seismic zones.

Step-7 Comparative the results in the term of storey-wise displacement, shear force, bending moment, node displacement etc.



RESULTS AND ANALYSIS.

ZONE	MAXIMUM DISPLACEMENT IN X DIRECTION IN mm		
	SOFT	MEDIUM	HARD
II	90.622	73.844	54.361
III	144.852	118.008	86.834
IV	217.158	176.892	130.131
V	325.618	265.218	195.077

Maximum Node Displacement (mm).

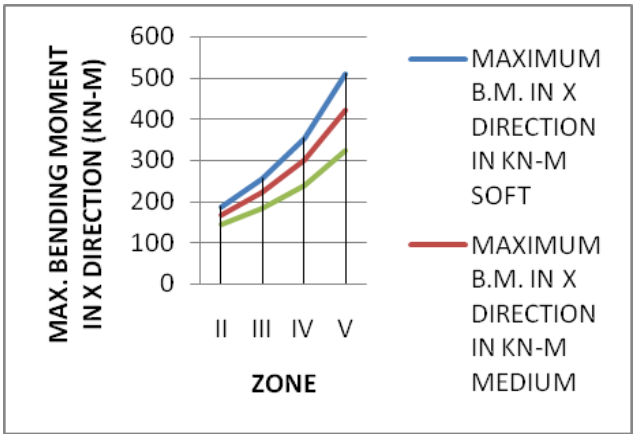
Maximum Shear Forces (KN)

ZONE	MAXIMUM SHEAR FORCE IN X DIRECTION IN KN		
	SOFT	MEDIUM	HARD
II	151.269	140.138	133.275
III	204.076	176.714	148.738
IV	277.777	236.734	189.071
V	388.329	326.764	255.27

S. No.	Parameter	Value	As per code
1	Zone (II,III,IV and V)	0.1, 0.16, 0.24 and 0.36 respectively	Table: 2
5	Damp ratio.	0.05	Table: 3
2	Importance. factor(I)	1.5	Table: 6
3	Response reduction (R.F)	5	Table: 7
4	soil site factor (S.S)	Soft,Medimm and Hard	

Maximum Bending Moment (KN-m)

ZONE	MAXIMUM B.M. IN X DIRECTION IN KN-M		
	SOFT	MEDIUM	HARD
II	188.369	167.615	144.634
III	257.581	222.921	183.667
IV	353.26	299.701	238.574
V	509.944	420.81	323.889



Maximum Support Reaction (KN)

ZONE	SOIL CONDITIONS		
	SOFT	MEDIUM	HARD
II	5177.04	5177.04	5177.04
III	5177.04	5177.04	5177.04
IV	5177.04	5177.04	5177.04
V	5439.906	5177.04	5177.04

2. CONCLUSIONS

As per the results shows that maximum node displacement, shear force and bending moment in zone V in soft soil while minimum at zone II and hard soil. It means that, of we increased the zones the node displacement is also increased. The results in the term of support reaction shows that zone II, III & IV are same with all type of soils but increased with change the zone from IV to zone V with soft soil. The maximum storey- wise displacement founded in zone V with soft soil and minimum at zone II with hard soil and also shows that if we increased the number of storey, node displacement is also increased. grounds. In India, a huge part of the rough ranges go under the seismic zone (II, III and IV) which determines its intensity as zone II is low where chances of occurrence of earthquake is low whereas zone V is very severe which means chances of earthquake is very high in this areas. In such case building frail against seismic tremor.

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