iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** XI **Month of publication:** November 2018

DOI: http://doi.org/10.22214/ijraset.2018.11028

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue XI, Nov 2018- Available at www.ijraset.com

Seismic Responses Analysis of Multistoried RC Building

Nitin Tiwari[1], Rashmi Sakalle[2], Vicky Kumar[3], Sheetal Dangi[4], Neha Verma[5]
[1,2]*Assistant Professor,* [3, 4, 5]*UG Student, Department of Civil Engineering, Truba Institute of Engineering and Information Technology, Bhopal M.P, India*

Abstract: ***The Aim of this project is to analyse and a multistorey building using software STAAD Pro. In STAAD-Pro analysis the Limit State of Design conforming of Indian Standard Code. We started with the analysis of frames and manually checked the accuracy of the software and compared with our results. In this we analyses G+4, G+9, G+14, & G+19 storey building initially for all possible load combinations likes [Dead, live and seismic loads]. We modelled the structure of different story like G+4, G+9, G+14 and G+19 and applied all zones (II, III, IV, & V) with different soil condition. By using STAAD.Pro that is very interactive software and user interface which gives the result according to seismic code (IS1893). Then according to the specified criteria assigned it analyses the structure and analysis the structure in different seismic Zone. In this paper we have to calculate such parameter as storey drift, displacement, Lateral forces, bending moment, Shear force, & axial forces.***
Keywords: ***EQ Analysis, Multi-Storey building, RC Structure, Seismic zone V/s Soil condition comparison***

I. INTRODUCTION

The earthquake is the natural disaster which can occur at any time and at any place which can leads to many structure collapse and structural damaged occurs and losses of human life and many others. So this results we have to design earthquake resistance building in earthquake prone areas. In this we have to analyse to earthquake behaviour of member RC frame structure under different type of loading condition and load combinations. In this we have consider basics three type of load. These such loads are dead load, live load and earthquake load or lateral load. Generally weakness in structure due to geometry and mass isolation of structure. These structures having this isolation are termed as Irregular structures. This irregularity in the structure contain a large portion of urban infrastructure. Due to vertical irregularity structures fail during earthquakes occurs**.** Now India has recently divided into four upgraded seismic zones and which cover the more than 60% of the land. Under such circumstances, seismic behaviour of existing buildings under revised codes has become important. The seismic rehabilitation of old concrete structures in high seismicity areas is a matter of evolving concern. The designing of the earthquake resistance building has to go through regular motion at its base, which leads to inertia forces in the building that will consecutively cause stresses. In the designing of earthquake resistant building, the normal building should be able to resist minor, moderate, sever shaking of the ground. In the circumstances of the building, symmetrical shape configuration building transfer the earthquake force in the direct path to the base, while in irregular shape configuration of building the load transferring path is indirect which leads to generation of stresses at the corners which leads to crack and damages occurs. During the warm shaking of earth the cantilever portion in building experience whiplash effect. Structure tends to swing in the direction in which are more flexible and have more oscillating time period. According to Indian seismic code 5% damping for all natural modes of oscillation for reinforced concrete building and 2% for steel structure issued. Building with large projections are not structurally accepted because they offer stresses are corners. Stresses on column on lower storey cause structural damage of building during earthquake shaking. Architects and structural engineers deal with earthquake design building with greater precision. In our study we have taken four different type of RC frame of different height, these such buildings are G+4, G+9, G+14 & G+19 and we study the seismic analysis in different zone (zone II, III, IV, V) with different soil condition using the STAAD Pro software which analysed the behaviour of all forces are coming on the RC frame.

II. SEISMIC ANALYSIS

Earthquake forces is shaking of random and time variant. But, most design codes represent the earthquake-induced inertia forces which leads or caused to motion as the net effect of such random shaking in the form of design equivalent static lateral force. So this force is called as the Seismic Design Base Shear $V_{B.}$ This force depends on the seismic hazard at the site of the building in the Seismic Zone Factor Z. this zone factor is various for zone to zone. In India their have classified in four category

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue XI, Nov 2018- Available at www.ijraset.com

Seismic zone	II	III	IV	V
Intensity	Low	Moderated	Severe	Very severe
Zone	0.10	0.16	0.24	0.36

Table 1 Seismic zone regarding zone value

III. OBJECTIVE OF PROJECT

A. Progressive changes of RC frame structure under different seismic zone and different soil condition.
B. Analysed a multistorey building under different type of earthquake zone(i.e., II, III, IV and V)
C. To compare the seismic response of multistorey buildings without shear wall in terms of Storey drift, Storey displacement, Shear force and Bending moment

IV. MODELING OF STRUCTURE

In this we are using 7 bay in X direction of different length and height of each storey is 3m except groung floor which is 2.5m the number of storey is set of 2D and 3D of G+4, G+9,G+14 and G+19 storey respectively. In all structure we using same column size 0.46x0.23m and two different size of beam are used for exterior wall the beam size is 0.23x .35m and inner wall is 0.23x0.30m. The providing all supports are fixed and the loads cases are used in this project are 1). Dead load 2). Live load 3). Lateral load due to Earthquake forces. The earthquake forces is apply on the whole part of RC frame of structure. The modeling process is followed by the following steps below.

1) Creation of all frame members using STAAD Pro.V8i
2) Assigning supports
3) Defining material to the members such as column and beam
4) Defining their section properties
5) Assigning material and sections to the members such as column and beam
6) Defining load patterns
7) Defining load cases

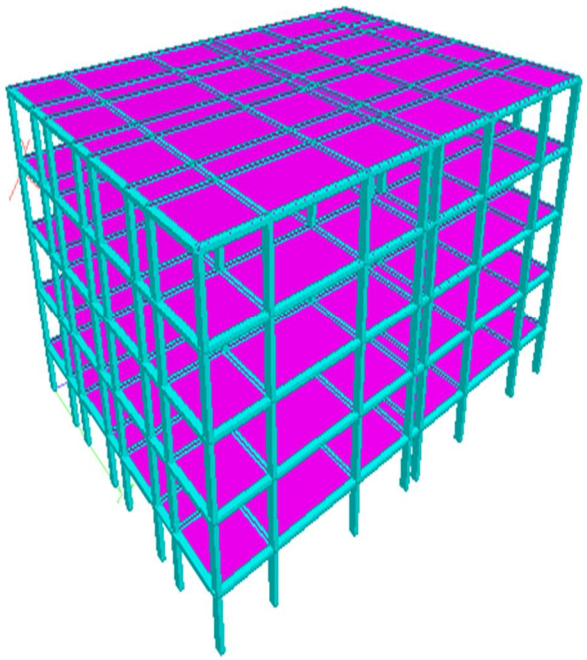


FIGURE 1Rendering viewG+4 storey structure

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue XI, Nov 2018- Available at www.ijraset.com

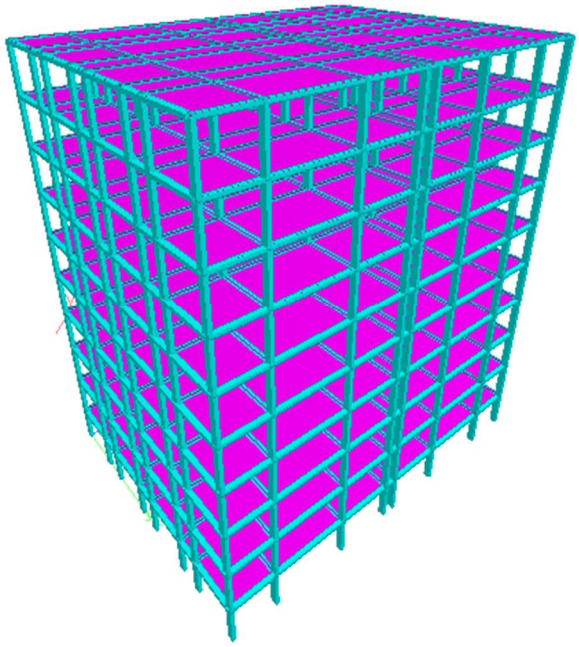


FIGURE 2 Rendering viewG+9 storey structure

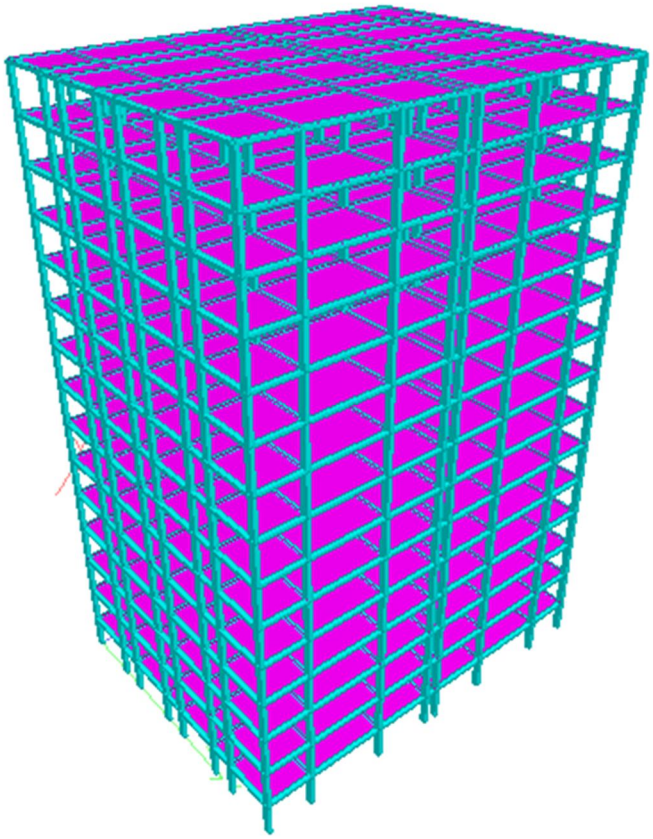


FIGURE 3 Rendering viewG+14 storey structure

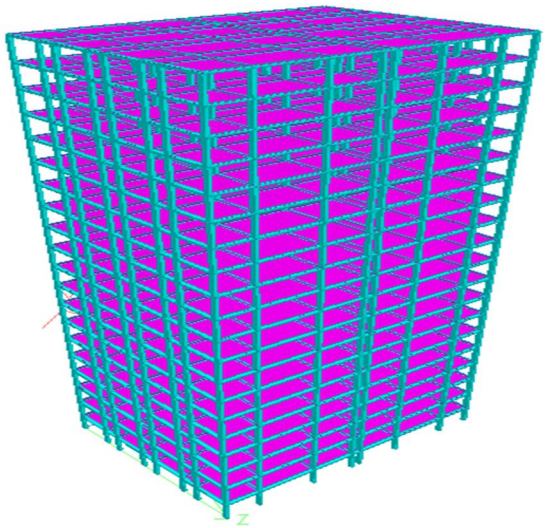


FIGURE 4 Rendering viewG+19 storey structure

V. ANALYSIS OF STRUCTURE

After the setting the all necessary data and assigning them for each members. We will set the all load cases act on model. In analysis combination of all the load condition are shown below.

Load case no.	Load cases
1	D.L
2	L.L
3	EQ_X +VE
4	EQ_X -VE
5	EQ_Z +VE
6	EQ_Z -VE
7	1.5(D.L+L.L)
8	1.2(D.L+L.L+EQ_X) +VE
9	1.2(D.L+L.L+EQ_X) -VE
10	1.2(D.L+L.L+EQ_Z) +VE
11	1.2(D.L+L.L+EQ_Z) -VE

Then we will run software and analysed, the software will take all the necessary information and do computation which is based on finite element analysis.

VI.RESULT AND DISCUSION

In the study on RC frame (G+4, G+9, G+14 and G+19) we will see the variation coming on building due to different type of loading condition. These such results are Storey Drift, Bending moment, Shear force, and Storey Deflection.

A. Storey Drift

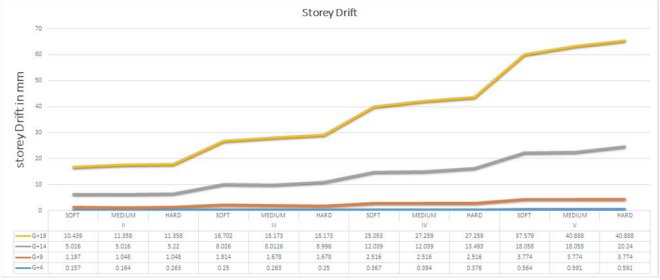


Figure 5storey drift

Structure	Maximum storey drift in mm	Zone & soil condition	Minimum storey drift in mm	Zone & soil condition
G+4	0.591	Vth zone Hard soil	0.157	IInd zone soft soil
G+9	3.774	Vth zone Hard soil	1.197	IInd zone soft soil
G+14	20.24	Vth zone Hard soil	5.016	IInd zone soft soil
G+19	40.888	Vth zone Hard soil	10.439	IInd zone soft soil

Table 2 Storey drift

B. Bending Moment Diagram

FIGURE 6 Bending Moment in kN-M

Bending moment in X-direction

Structure	Maximum B.M (kN-M)	Zone & soil condition	Minimum B.M(kN-M)	Zone & soil condition
G+4	121.21	Vth zone Hard soil	33.738	IInd zone soft soil
G+9	208.125	Vth zone Hard soil	70.909	IInd zone soft soil
G+14	542.284	Vth zone Hard soil	134.87	IInd zone soft soil
G+19	692.048	Vth zone Hard soil	116.098	IInd zone soft soil

Table 3 Bending moment table in X-direction

Bending moment in Y-direction

Structure	Maximum B.M (kN-M)	Zone & soil condition	Minimum B.M(kN-M)	Zone & soil condition
G+4	0.089	V^{th} zone Hard soil	0.012	II^{nd} zone soft soil
G+9	0.386	V^{th} zone Hard soil	0.078	II^{nd} zone soft soil
G+14	1.437	V^{th} zone Hard soil	0.159	II^{nd} zone soft soil
G+19	1.832	V^{th} zone Hard soil	0.175	II^{nd} zone soft soil

Table 4 Bending moment table in Y-direction

Bending moment in Z-direction

Structure	Maximum B.M (kN-M)	Zone & soil condition	Minimum B.M(kN-M)	Zone & soil condition
G+4	88.931	Vth zone Hard soil	28.87	IInd zone soft soil
G+9	175.671	Vth zone Hard soil	53.472	IInd zone soft soil
G+14	406.063	Vth zone Hard soil	113.483	IInd zone soft soil
G+19	517.46	Vth zone Hard soil	143.413	IInd zone soft soil

Table 5 Bending moment table in Z-direction

C. Shear Force Diagram

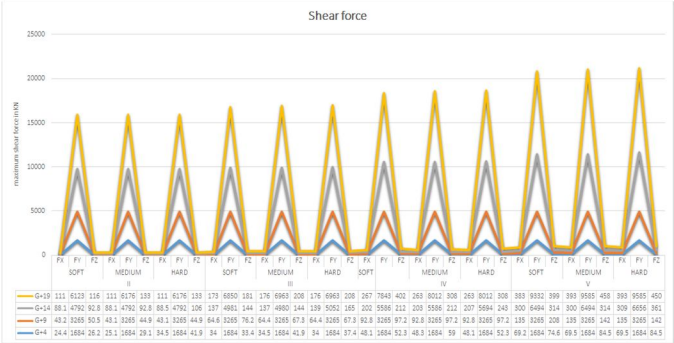


Figure 7 Shear Force in kN

Shear force in X-direction

Structure	Maximum S.F(kN)	Zone & soil condition	Minimum S.F(kN)	Zone & soil condition
G+4	69.5	V^{th} zone Hard soil	24.404	II^{nd} zone soft soil
G+9	135.465	V^{th} zone Hard soil	43.202	II^{nd} zone soft soil
G+14	308.977	V^{th} zone Hard soil	88.108	II^{nd} zone soft soil
G+19	393.263	V^{th} zone Hard soil	110.643	II^{nd} zone soft soil

Table 6 Shear force in X-direction

Shear force in Y-direction

Structure	Maximum S.F(kN)	Zone & soil condition	Minimum S.F(kN)	Zone & soil condition
G+4	1684.268	V^{th} zone Hard soil	1684.268	II^{nd} zone soft soil
G+9	3265.47	V^{th} zone Hard soil	3265.47	II^{nd} zone soft soil
G+14	6655.827	V^{th} zone Hard soil	6655.827	II^{nd} zone soft soil
G+19	9584.884	V^{th} zone Hard soil	9584.884	II^{nd} zone soft soil

Table 7 Shear force in Y-direction

Shear force in Z-direction

Structure	Maximum S.F(kN)	Zone & soil condition	Minimum S.F(kN)	Zone & soil condition
G+4	84.534	Vth zone Hard soil	41.93	IInd zone soft soil
G+9	141.903	Vth zone Hard soil	67.323	IInd zone soft soil
G+14	360.659	Vth zone Hard soil	143.85	IInd zone soft soil
G+19	458.284	Vth zone Hard soil	208.196	IInd zone soft soil

Table 8 Shear force in Z-direction

D. Storey Deflection

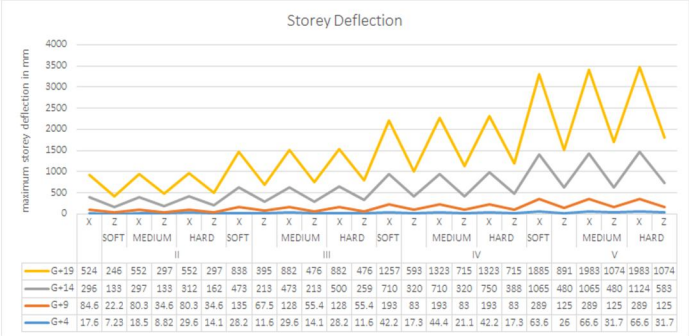


Figure 8 Storey Deflection

Storey Deflection in X-direction

Structure	Maximum storey deflection in mm	Zone & soil condition	Minimum storey deflection in mm	Zone & soil condition
G+4	66.644	Vth zone Hard soil	17.608	IInd zone soft soil
G+9	288.873	Vth zone Hard soil	84.623	IInd zone soft soil
G+14	1124.257	Vth zone Hard soil	295.939	IInd zone soft soil
G+19	1983.432	Vth zone Hard soil	523.856	IInd zone soft soil

Storey deflection in Z-direction

Structure	Maximum storey deflection in mm	Zone & soil condition	Minimum storey deflection in mm	Zone & soil condition
G+4	31.719	Vth zone Hard soil	7.23	IInd zone soft soil
G+9	124.529	Vth zone Hard soil	22.165	IInd zone soft soil
G+14	582.684	Vth zone Hard soil	133.388	IInd zone soft soil
G+19	1074.325	Vth zone Hard soil	246.183	IInd zone soft soil

VII. CONCLUSION

A. Storey Drift

Among all RC frame the maximum "STOREY DRIFT" occurs that we have analyzed in V^{th} zone in hard soil condition.

B. Bending Moment

Among all RC frame the maximum "BENDING MOMENT" occur that we have analyzed in V^{th} zone with hard soil.

C. Shear Force

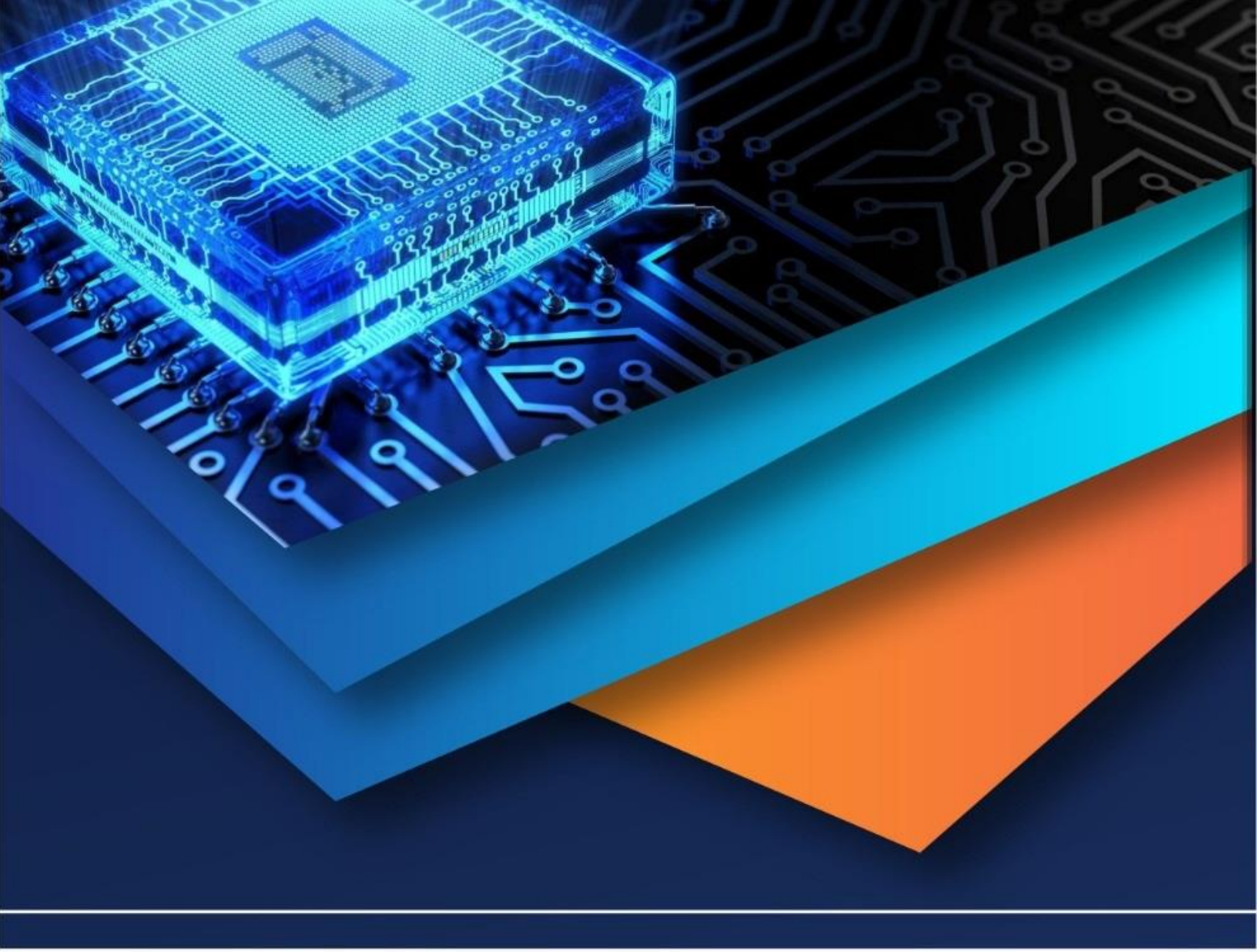
Among all RC frame the maximum "SHEAR FORCE" occur that we have analyzed in V^{nd} zone in hard soil condition.

D. Storey Deflection

Among all RC frame the maximum "STOREY DEFLECTION" occur that we have analyzed in V^{th} zone in soft soil condition

REFERNCES

[1] Prof. S.S. Patil (2015) [1] "seismic analysis of high rise building using program in STAAD Pro. While considering different conditions of the lateral stiffness system"
[2] Mohit Sharma et. al. (2014)[2]Comparative Study of Performance of RCC Multistorey Building For Koyna and Bhuj Earthquakes IS: 1893-2002 (part-1), Bureau of Indian Standards, New Delhi.
[3] Mayuri D. Bhagwat et, al (2014)[3] "Dynamic analysis of G+12 multistorey practiced RCC building considering for Koyna and Bhuj earthquake is carried out response spectrum analysis and seismic responses"
[4] Himanshu Bansal et. al. (2013)[4] "study on storey shear force was found to be maximum for the first storey and it decreased to a minimum in the top storey".
[5] Ketan Bajaj et. al. (2013)[5] "studied different type of building subjected to different earthquake loading and behaves differently with diversification in the types of soil condition".
[6] Md. Arman Chowdhury, (2012) [6]"Comparative study of the Dynamic Analysis of Multi-storey Irregular building with or without Base Isolator".
[7] IS: 875-1987 (part-1) for Dead Loads, code of practice of Design loads (other than earthquake) for buildings and structures.
[8] IS: 875-1987 (part-2) for Live Loads or Imposed Loads, code of practice of Design loads (other than earthquake) for buildings and structures.
[9] IS 1873-2002/2005 for seismic analysis of RC frame.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY