iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** IV **Month of publication:** April 2017

DOI: http://doi.org/10.22214/ijraset.2017.4062

www.ijraset.com

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

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Analysis of a RC Building Frame on Terrain Considering Different Seismic Zone

Anubhav Rai[1], Rajkumar Vishwakarma[2]
[1]Assistant Professor, [2]M-Tech Student (Structural Engg.)
Gyan Ganga Institute of Technology & Science Jabalpur M.P, India

Abstract: ***This research paper consists on "Seismic Analysis of Building frames on Hilly Terrain" as per I.S. 1893 part1. (Structures) on sloping ground require more importance in analysis than those on plane strata. Structures on the slanting grounds are constantly unpredictable and unsymmetrical in both flat and vertical headings and have establishment have at various levels. All this means centre of mass and centre of rigidity do not coincide with each other, which requires considering torsional effect during analysis. Short columns affect more damage in earthquake. Such buildings pose special structural and constructional problems. In this study we adopt the loading combination in each case as per 875 part V and dimension of column (400mm x 400mm) and the beam (350mm x 280mm) in all the cases. In this study we consider two Seismic Zone III and IV with different type of soil like soft and hard soil as per IS Code 1893 Part I. On multi-storey structures of (G+10) here we consider the comparative study on sloping ground angle 0, 7 & 14 degree.***

Here we will discuss the results in the terms of Axial force, Maximum Bending Moment, Storey Displacement and Shear Force.

Keywords— STAAD.PRO, storey displacement, max bending moment, structural analysis, seismic analysis, Seismic Zones, Soils

I. INTRODUCTION

Now a day in many parts of the world, Seismic load and its effect is concerned the issue with respect to the well-being of existing structures. In the previous couple of years, structures were outlined and built by before standard code arrangements (with or without considering Earthquake Forces), don't fulfill necessities of current seismic code and configuration hones. Along these lines, it is fundamental to make safe unsuitable perils to property and life of tenants, postured amid future seismic tremor. The wellbeing from risks is conceivable by method for seismic assessment and execution, retrofitting of deficient existing building structures. Catastrophe because of Earthquake has dependably been one of the best common disasters push onto the humankind since time immemorial, acquiring its wake untold agonies and hardships to the general population influenced.

North and north eastern parts of India have huge extends of uneven landscape, which are ordered under seismic zone II, III, IV and V. In this locale the development of multistory RCC surrounded structures on slope inclines is in squeezing request, because of monetary development and fast urbanization. This development in development action is adding to gigantic increment in populace thickness. While developing, it must be noticed that Hill structures are unique in relation to those in fields i.e., they are exceptionally sporadic and unsymmetrical in even and vertical planes, and torsionally coupled. Since there is shortage of plain ground in slopes, it commits the development of structures on inclines.

In this study we considered sloping angle of 0o, 7o and 14 degree, seismic zone III & V, soil type soft and medium.and G+10 structure.

SUJIT KUMAR et al. (2014) [1] observed the behavior of slanting ground structures considering inclinations of (7.50, 15o) under seismic forces. Considering seismic zones comparison has been done on sloping ground and plane ground building. Here G+ 4 storey is taken with same properties and loadings for its conduct and comparison. And observed that vertical forces remain same whereas vertical force and bending moment increases with increase in sloping angels.

S.M.Nagargoje et al. (2012) [8] compared sloping ground and plain ground building ranging from storey 4 to15 with same properties the seismic analysis of buildings are carried out by Seismic coefficient method by using IS 1893(part I) -2002 considering seismic zone III. They concluded that Top storey displacement of Step back building is quite high as compared to Step back-Setback building resting on sloping ground. Step back-Setback building may be Favored on sloping group.

A. Primary Objectives of our Study

1) Is to determine the Seismic effect of different seismic zones
2) To determine the impact due to sloping ground

©IJRASET: All Rights are Reserved

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

3) To find out the variation due to different types of soil considered

II. METHODOLOGY

This study deals with comparative study of Earthquake behaviour on multistorey structure (G+10) of unsymmetrical 3 bays of 3,4&5m towards X & Z direction (plan 12m x12m) building frame with three different soil types and different slope of ground as 0^0, 7^0 and 14^0. Under the Earthquake effect as per IS 1893(part I) -2002 static analysis. A comparison of analysis results in terms of Maximum bending moment, Maximum Axial Force, Maximum Storey Displacement, Maximum shear force has been carried out

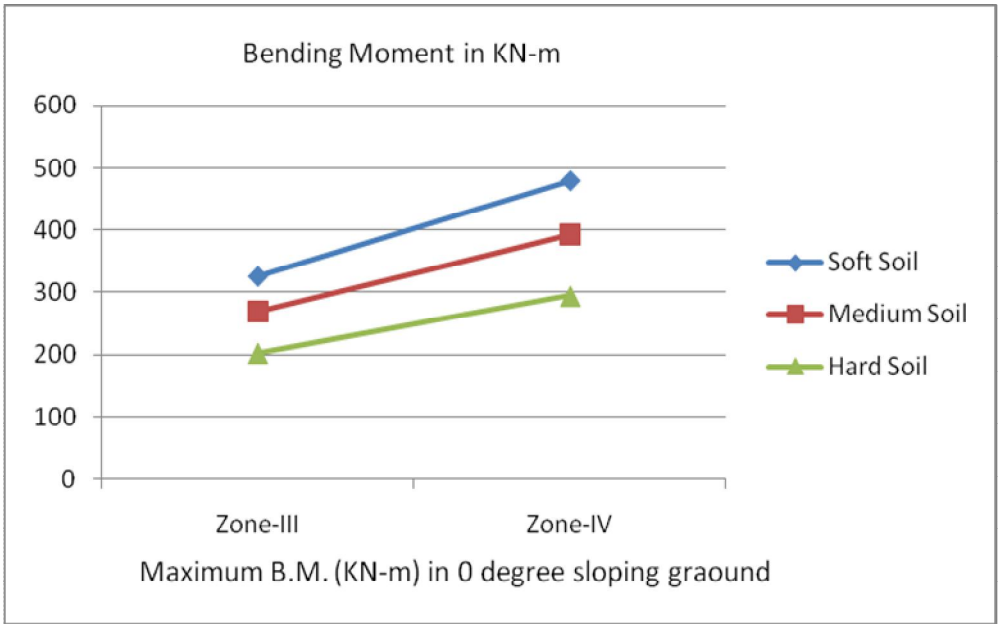
A. In this Study the Following Steps are Adopt

1) NDraw the Model in Stadd Pro V8i
2) Provide the Proper slopes
3) Provide Supports and Proper Property
4) Provide the Seismic Loading as per the IS Code 1893 Part-I
5) Analyse the Structure.

III. RESULT AND ANALYSIS

A. Bending Moment

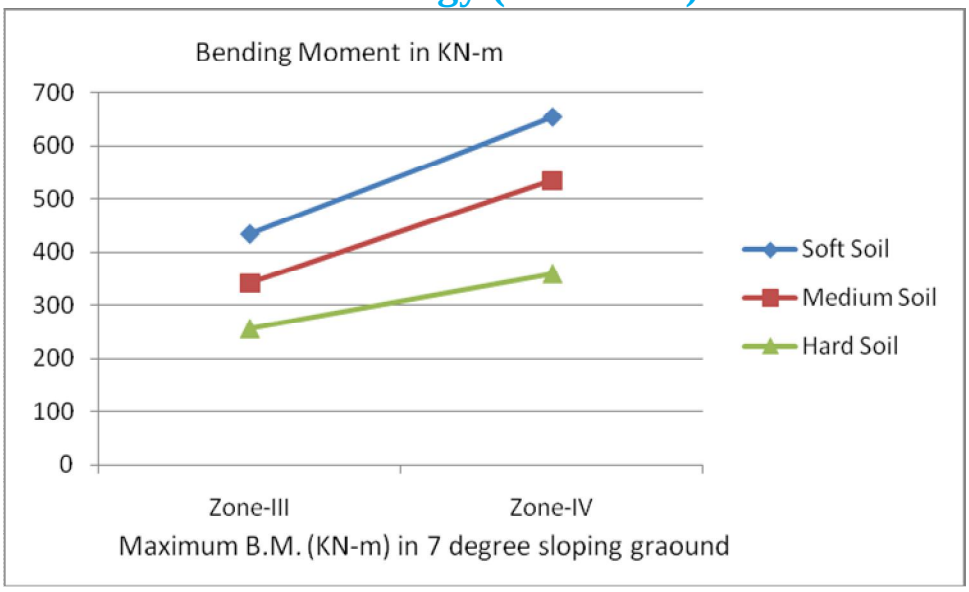
Soil Type	Maximum Bending Moment (kN-m) in 0 degree sloping ground	
	Zone-III	Zone-IV
Soft	325.76	478.88
Medium	268.38	393.30
Hard	203.42	294.76



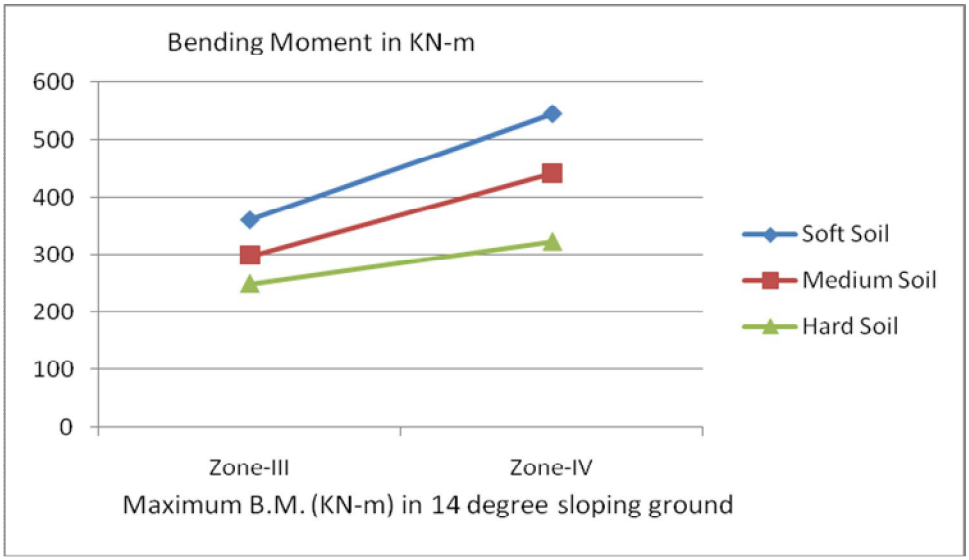
Soil Type	Maximum Bending Moment (kN-m) in 7 degree sloping ground	
	Zone-III	Zone-IV
Soft	434.3	653.36
Medium	342.16	534.92
Hard	256.34	359.51

©IJRASET: All Rights are Reserved

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)



Soil	Maximum Bending Moment (kN-m) in 14 degree sloping ground	
	Zone-III	Zone-IV
Soft	360.83	544.63
Medium	298.39	442.27
Hard	249.47	323.39

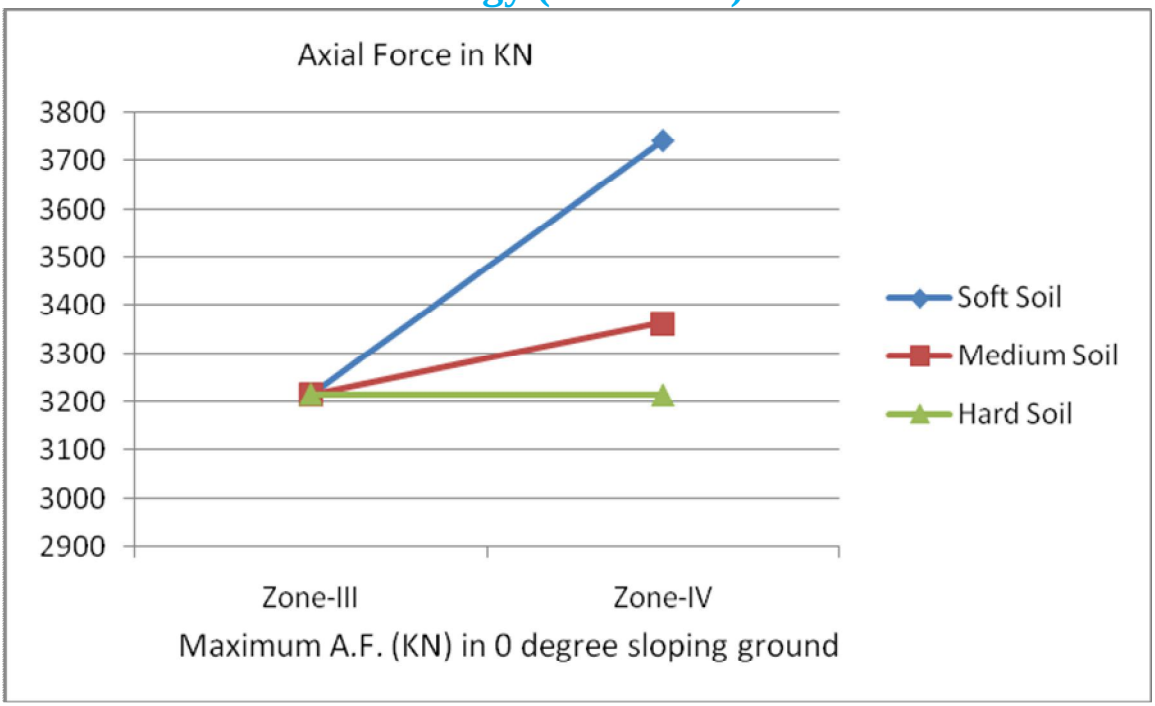


B. Axial Force

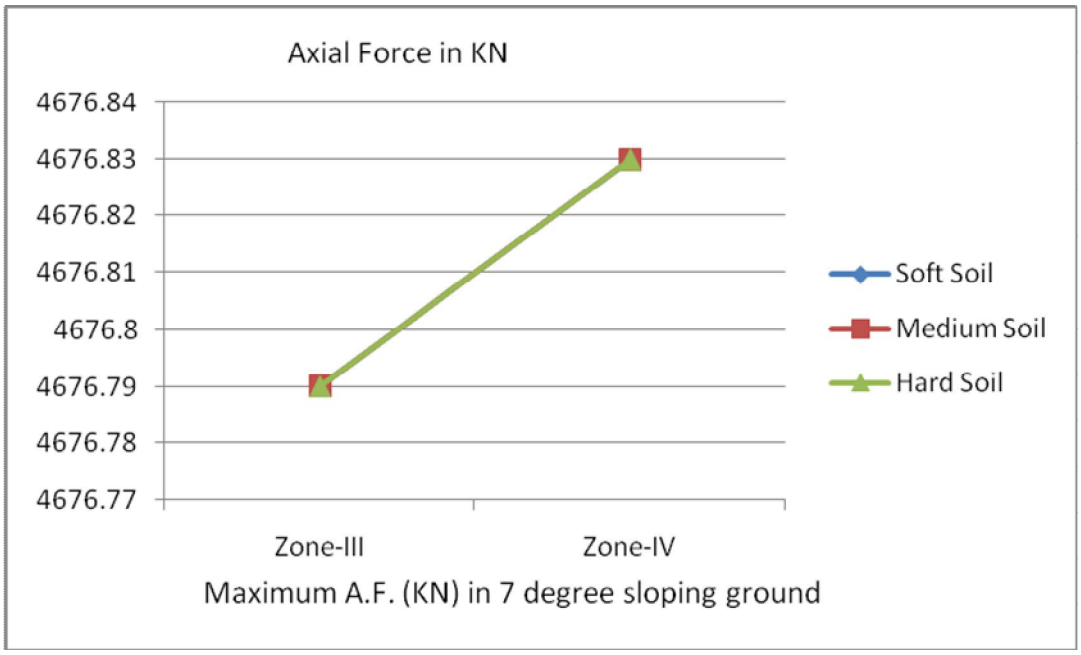
Soil type	Axial force kN in 0 degree slope	
	Zone III	Zone IV
Soft	3216.65	3742.96
Medium	3216.65	3364.71
Hard	3216.65	3214.72

©IJRASET: All Rights are Reserved

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)



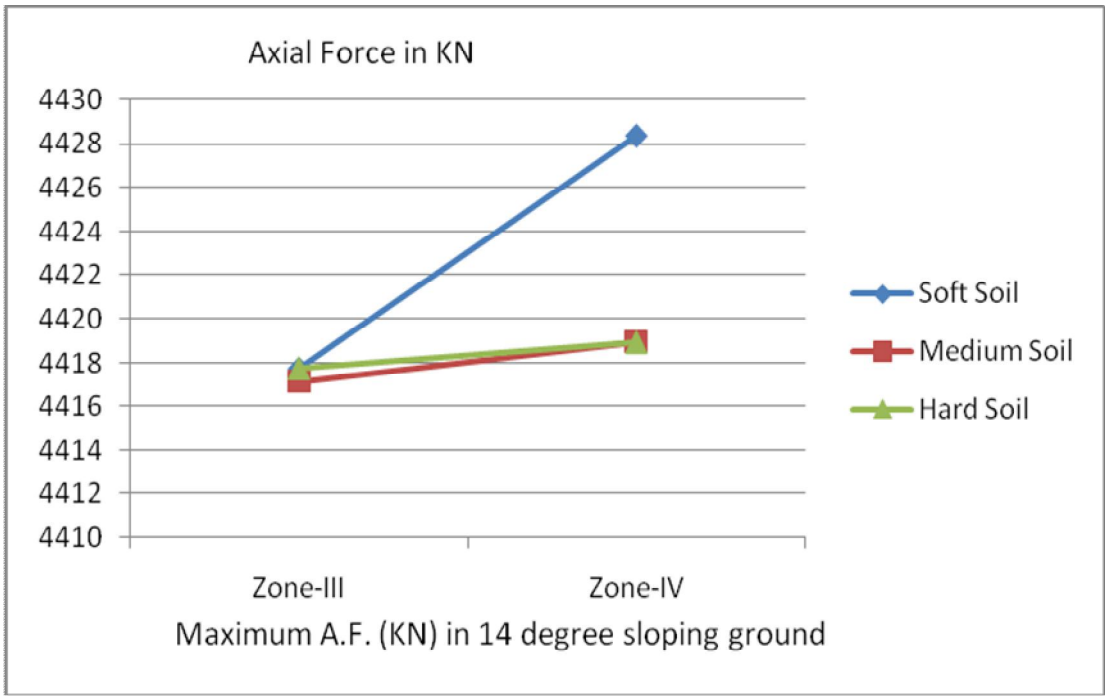
Soil type	Axial force kN in 7 degree slope	
	Zone III	Zone IV
Soft	4676.79	4676.83
Medium	4676.79	4676.83
Hard	4676.79	4676.83



©IJRASET: All Rights are Reserved

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Soil type	Axial force kN in 14 degree slope	
	Zone III	Zone IV
Soft	4417.75	4428.35
Medium	4417.75	4418.95
Hard	4417.75	4418.95

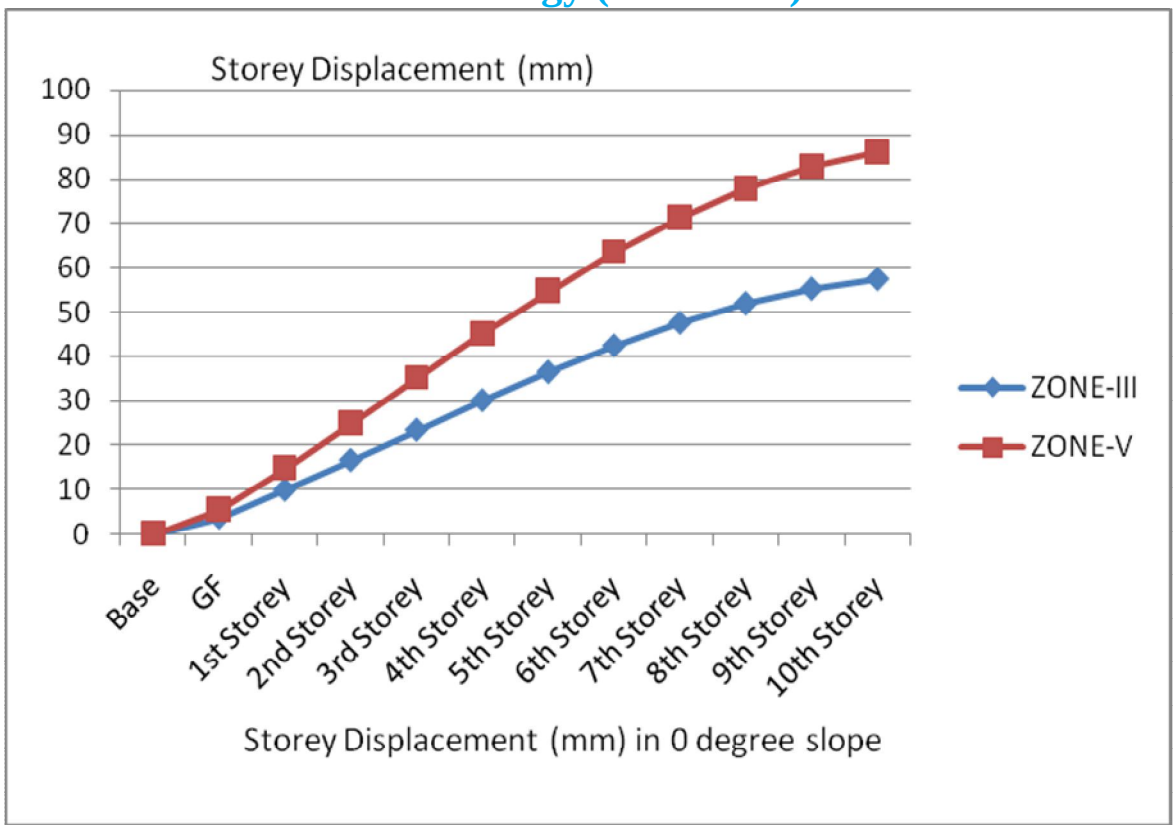


C. Storey Displacement

Storey	Storey Displacement (mm) 0 degree slope	
	ZONE-III	ZONE-V
Base	0	0
GF	3.68	5.52
1st Storey	9.89	14.82
2nd Storey	16.62	24.94
3rd Storey	23.42	35.13
4th Storey	30.09	45.14
5th Storey	36.47	54.71
6th Storey	42.38	63.57
7th Storey	47.62	71.40
8th Storey	51.99	77.93
9th Storey	55.28	82.93
10th Storey	57.46	86.20

©IJRASET: All Rights are Reserved

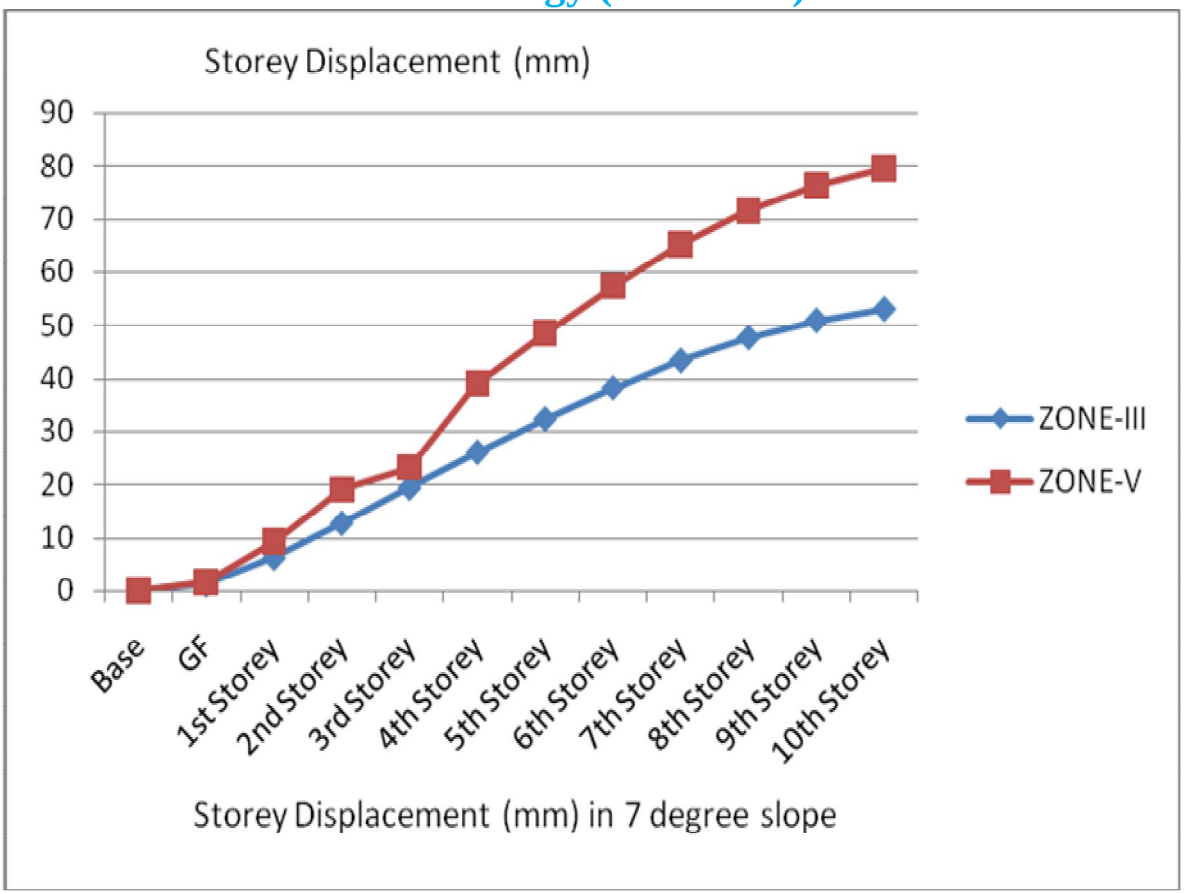
Volume 5 Issue IV, April 2017
ISSN: 2321-9653



Storey	Storey Displacement (mm) 7 degree slope	
	ZONE-III	ZONE-V
Base	0	0
GF	1.15	1.73
1st Storey	6.24	9.30
2nd Storey	12.77	19.13
3rd Storey	19.42	23.18
4th Storey	26.05	39.08
5th Storey	32.31	48.57
6th Storey	38.22	57.34
7th Storey	43.42	65.16
8th Storey	47.73	71.59
9th Storey	50.96	76.44
10th Storey	53.10	79.65

©IJRASET: All Rights are Reserved

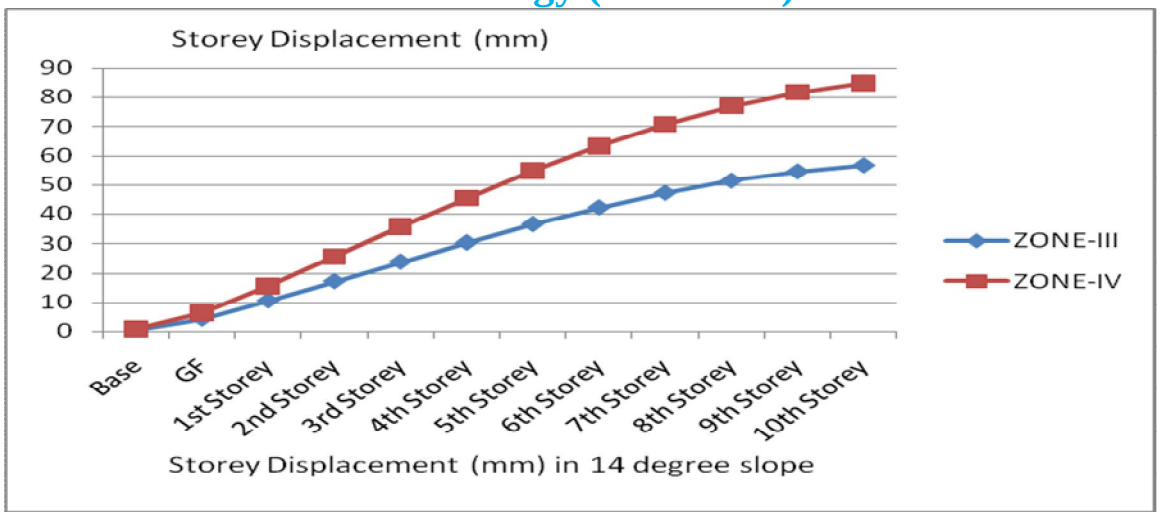
Volume 5 Issue IV, April 2017
ISSN: 2321-9653



Storey	Storey Displacement (mm) 14 degree slope	
	ZONE-III	ZONE-IV
Base	0.54	0.81
GF	4.23	6.34
1st Storey	10.47	15.65
2nd Storey	17.12	25.70
3rd Storey	23.81	35.72
4th Storey	30.30	45.49
5th Storey	36.51	54.78
6th Storey	42.20	63.30
7th Storey	47.23	70.84
8th Storey	51.41	77.13
9th Storey	54.57	81.85
10th Storey	56.70	85.06

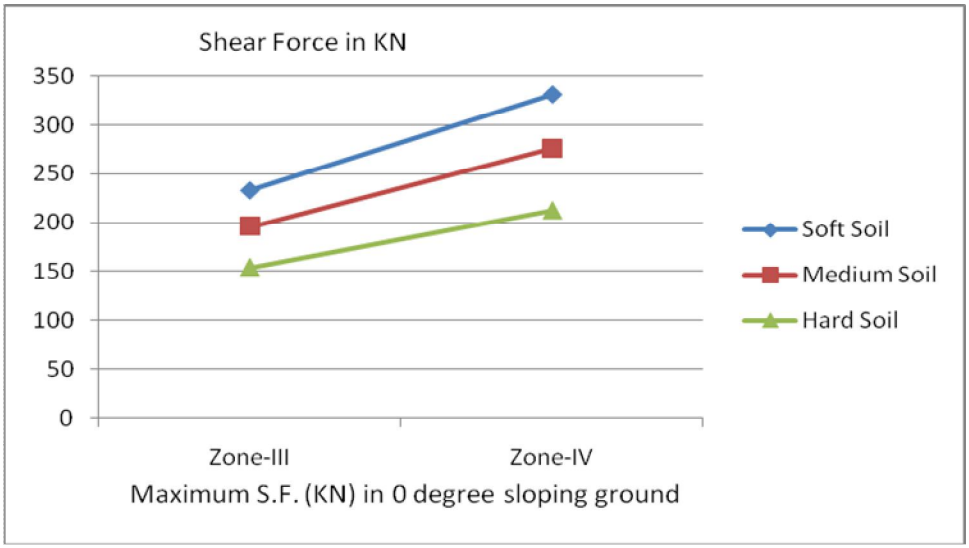
©IJRASET: All Rights are Reserved

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)



D. Shear Force

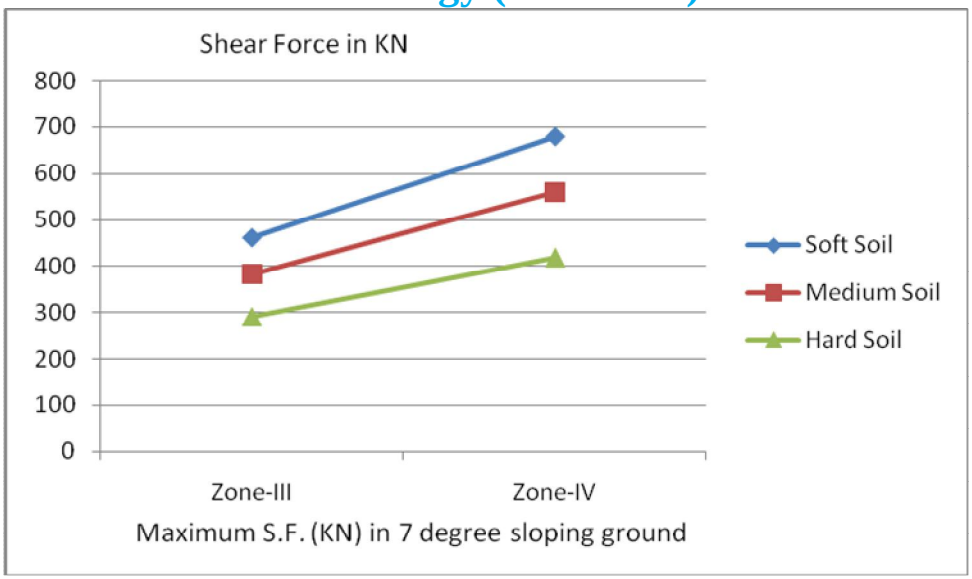
Soil type	Shear force kN in 0 degree slope	
	Zone III	Zone IV
Soft	232.90	330.80
Medium	196	276.30
Hard	154.4	213.00



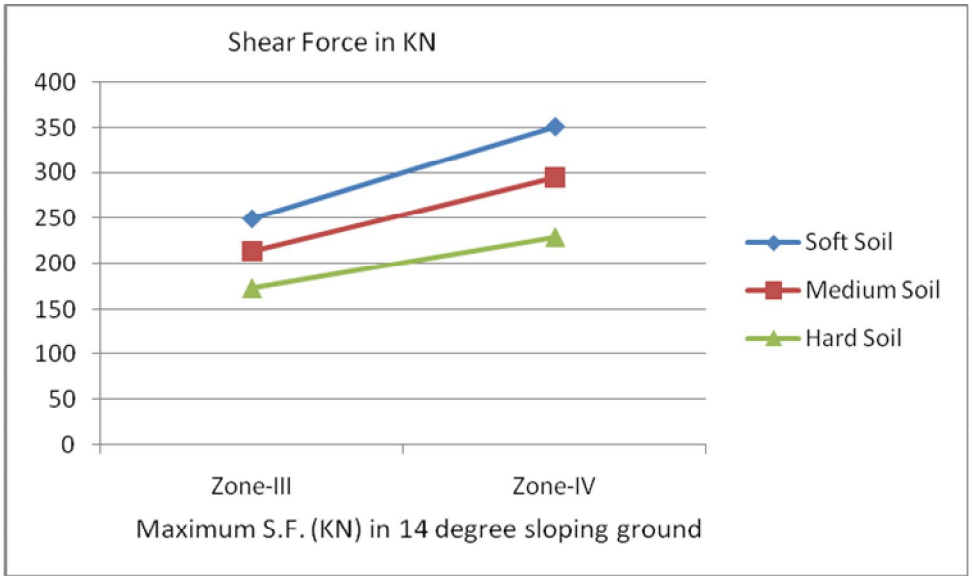
Soil type	Shear force kN in 7 degree slope	
	Zone III	Zone IV
Soft	462.214	680.381
Medium	382.175	558.893
Hard	289.963	418.035

©IJRASET: All Rights are Reserved

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)



Soil type	Shear force kN in 14 degree slope	
	Zone III	Zone IV
Soft	249.64	351.27
Medium	213.45	294.68
Hard	172.51	229.39



IV. CONCLUSION

A. Our Study Concluded that

1) Comparison to the sloping ground, plain ground buildings are most suitable.

2) Maximum Bending Moment is observed in soft soil and Minimum in Hard soil therefore hard soil is stable. Similarly maximum bending moment is observed in zone IV and minimum in zone III and also comparing the slopes, in 14 degree slope and 0 degree slope are provide the maximum and minimum bending moment respectively. That means as slope is rising bending moment is also rising.

©IJRASET: All Rights are Reserved

3) In the comprising in the term of shear force, soft soil and Zone III observed maximum shear force while in hard soil and IV zone seen minimum.

4) Maximum axial forces is seen that maximum in soft soil and minimum in hard soil that means the hard soil is more best.

5) As comprising the maximum storey displacement is seen in soft soil , seismic zone IV and 14 degree of sloping ground while hard soil, zone III and 0 degree sloping ground as minimum.

6) The buildings which are resting on sloping ground are subjected to short column effect, attract more base shear &forces and areworst affected during seismic excitation.

REFERENCES

[1] Shashi K. Kunath1 Asso. Member, ASCE, Andrei M. Reinhohon2 Member, ASCE, and Young J. Park3, Asso. Member, ASCE. Journal of Struct. Engg. Vol.116 No. 4 April-1990 “Analytical Modeling Of In Elastic Seismic Response of R/C Structures.

[2] Prof. Paul. D.K.1 IIT, Roorkee, india, at Bull. Ind. Soc. Earthquake Technology, Paper No.335,Vol. 30,No.4 ,Dec 1993 “Simplified seismic analysis of frame building on hill slope”

[3] Shivanand and B H. S. Vidyadhara (2014) “ Design of 3D RC frame on sloping Ground” International Journals of Research in Engineering and Technology. Vol. 3, Issue 8. 307-317.

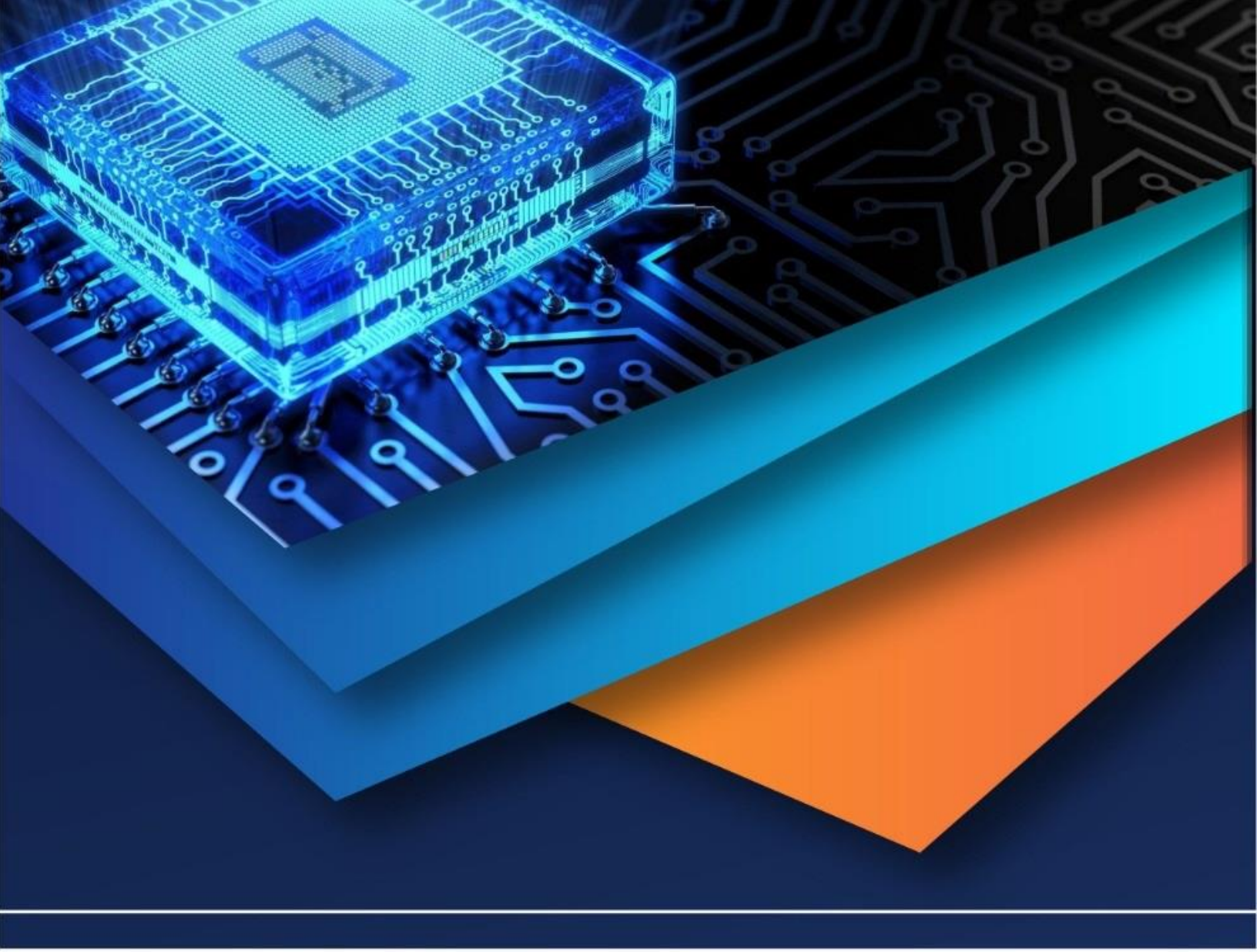
[4] Prof. Jaswant N. Arlekar, Prof. Sudhir K. Jain and Prof. C.V.R. Murty, Dept. of Civil Engg. IIT Kanpur , CBRI ,1997,New Dehli, India. “Seismic Response of RC Frame Building With Soft First Storey” .

[5] Prof.Paul, D.K.1 & Prof.Satish kumar 2 , seismic bulding on hill slope , IIT, Roorkee, India. 6. Prof. Paul, D.K.1 & Prof.Satish kumar 2, IIT, Roorkee, india, at Bull. Ind. Soc. Earthquake Technology, Pper No.365,Vol. 34, No.2 ,June 1997 . “Seismic Analysis Of Stepback And Setback Buildings”

[6] Prof. Xiaojun ZHANG1 and Prof.John L MEEK, 12WCE2000 . “Analysis of Highrise Buildind Structure With Setback Subject To EarthquakeGround Motions”

[7] Asso. Member, ASCE Mr. Joann P. browning 1, Journal Of Structural Engineering Feb-2001 , “ Preportioning Of Earthquake- Resisting RC Building Structures .”

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)