International Journal of Research in Advent Technology, Vol.6, No.8, August 2018
E-ISSN: 2321-9637
Available online at www.ijrat.org

Structural Analysis of Multi-Storied Building for Different Plan Configuration for Different Types of Soil Considering Equivalent Strut Approach

Nilesh Sanjiv More[1], P. A. Nikam[2], B. R. Lagad[3]
[1]PG Student (M.E. Structures),[2]Assistant Professor and guide, [3]Assistant Prof.,[1,2,3]department of Civil Engineering, [1,2]S. N. D. C. O. E. & R. C. Yeola, Nasik, [3]L. G. N. S. C. O. E, Nasik, Maharashtra, India.
[1]nileshmore8114@gmail.com,[2]pravinnikam16@gmail.com,[3]balramlagad9124@gmail.com.

Abstract-In India, soil conditions are different in different regions which plays important role during earthquake shaking. Soil having number of layers at various depths at different locations doesn't show same response during earthquake. Infill walls are referred as non-structural element during design but effect of infill walls on structure during earthquake is also considered which called as equivalent strut method. Irregular building does not show same response in all directions during earthquake. In current study, analysis of plan irregularity of building and consideration of soil structure interaction under seismic loading. Aimed with purpose, the plan irregular building (G+20) is analyzed by using Etabs subjected to the combination of gravity load and seismic load under specific zone. Compare the same building with equivalent strut approach and without equivalent strut approach consideration of different soil condition structure interaction; it is analyzed by using the Etabs software.

Key words - Irregular buildings, Equivalent strut approach, Different soil conditions, E-tab

1. INTRODUCTION

1.1 General

Multi-storied buildings causes structural irregularity with respect to stiffness. Unfortunately, lots of buildings in India leads to collapse under lateral forces due to structural irregularity. In current study analysis of plan irregularity of building and consideration of soil structure interaction under seismic loading is considered with equivalent strut approach.

1.2 Analysis of multistorey building with different soil conditions

Soil has different properties at various locations and depths. Testing of soil samples of various locations in laboratory does not shows same properties. This changes in properties cause serious effect on stability of multistoried building.

1.3 Analysis of multistorey building with different plan configurations

Irregularities are of different types such as stiffness irregularities, vertical geometric irregularities, Weight (mass) irregularities, Discontinuity in capacity etc. In this study, various buildings of different plan configurations are considered for analysis.

1.4 Analysis of multistorey building with consideration of infill walls by equivalent strut method.

A building without infill walls cause serious structural problems during earthquake, infill walls doesn't have any type of loading except its own weight but it helps columns to be stand against lateral loads i. e. earthquake forces.

2. LITERATURE REVIEW

Thupden Tashi Lachenpa Bhutia, Dr. Rajendra. S., Vijay. K. (July 2016), have carried out a study on the seismic analysis of RC frame structure by taking different soil types and considering soil structure interaction with fixed and spring base in different zones of India. Different soils types are considered for soil structure interaction study. In this study they concluded that the Deflection, Shear Force Bending Moment, Beam End Forces, Displacement, Beam Stresses, Sectional Force and Bending Moment were noticed maximum in Zone V for all cases considered for this study. (1)

Akhil R, Aswathy S Kumar (June 2017**)** have carried out study on Response spectrum analysis (RSA) of vertically irregular RC building. In this study, they reported that the overall performance of regular building is more strengthen than irregular building Software. They also reported that the time period require for H-shaped plan configuration is more as compared to other considerations. In this study, they concluded that maximum displacement for regular shapes and minimum for irregular shapes. (6)

Mamathashree K. S., Sanjay S. J. (November 2016) have studied the effect of seismic evaluation of RC framed irregular buildings with soil structure interaction. In this research, they studied the RC special moment resisting frame buildings for seismic response of 4, 8, 12 stories regular and irregular structure with consideration of different types of soil by using linear response spectrum analysis with and without soil structure interaction effect.They also examined the regular and irregular buildings for the effect of soil structure interaction for different soil types. (7)

Veena S Ravi, SreedeviLekshmi (2015)have studied effect of Shape and Plan Configuration on Seismic Response of Structure (ZONE II & V). In this study, they concluded that the building with regular square plan have the maximum base shear value as compared with other irregular plan shapes and “L” shaped plan configuration have least base shear value in IInd and Vth zone. Stiffness of structure hence the structure becomes more flexible due to this natural period increase. (8)

3. OBJECTIVES:

- To develop, design and analyze model of the High rise structure (G+20) in Etabs software.
- Comparison of results of earthquake load applied on the structure by software in Zone III for soft, medium and hard soil condition.
- To compare results of storey drift, Deflections, Stresses, Shear force and Bending Moments.

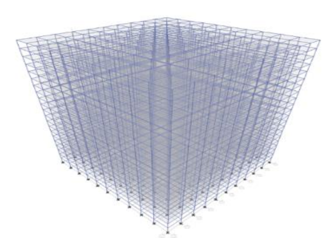
A) MODEL DESCRIPTION

Sr. No.	Model Description	Shape of model	Type of soil	Equivalent Strut Approach
		Part-I		
1	M1-1	Square	Soft	Without
2	M1-2	Square	Medium	Without
3	M1-3	Square	Hard	Without
4	M2-1	Rectangular	Soft	Without
5	M2-2	Rectangular	Medium	Without
6	M2-3	Rectangular	Hard	Without
7	M3-1	I-Shape	Soft	Without
8	M3-2	I-Shape	Medium	Without
9	M3-3	I-Shape	Hard	Without
10	M4-1	L-Shape	Soft	Without
11	M4-2	L-Shape	Medium	Without
12	M4-3	L-Shape	Hard	Without
13	M5-1	T-Shape	Soft	Without
14	M5-2	T-Shape	Medium	Without
15	M5-3	T-Shape	Hard	Without
16	M6-1	C-Shape	Soft	Without
17	M6-2	C-Shape	Medium	Without
18	M6-3	C-Shape	Hard	Without

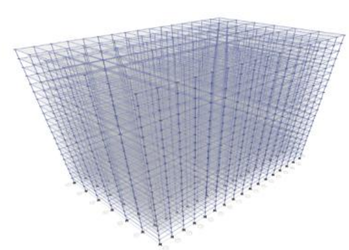
B)Table No 3.1:Details of Model:

Number of stories	21 no’s
Storey height	3.0m
Size of column	700X700 mm
Size of beam	230X450 mm
Thickness of Deck	150mm
Density of concrete	25kN/m^3
Wall external	230mm
Wall Internal	230mm
Live load	2kN/m^2
FF	1.5kN/m^2
Importance factor (I)	1
Seismic zone	III
Response reduction factor	5

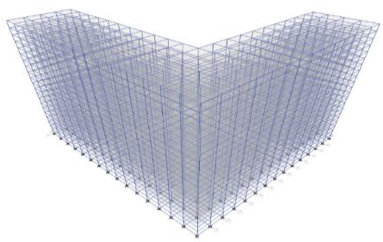
C) MODELS



3D Plan of M1



3D Plan of M2



3D Plan of M3

4. RESULTS AND DISCUSSION

A. Results for displacement

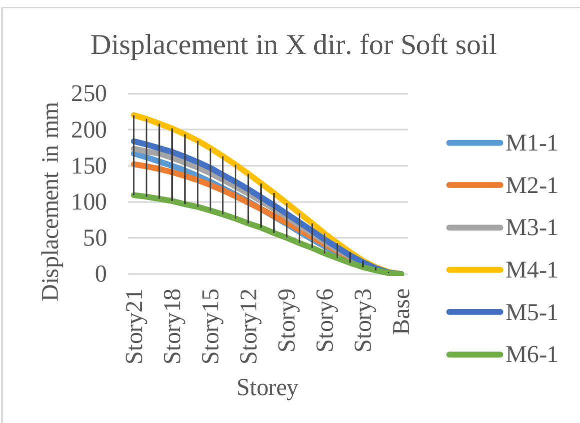


Fig 1 Displacement in X direction for Soft soil

Fig 2 Displacement in Y direction for Soft soil

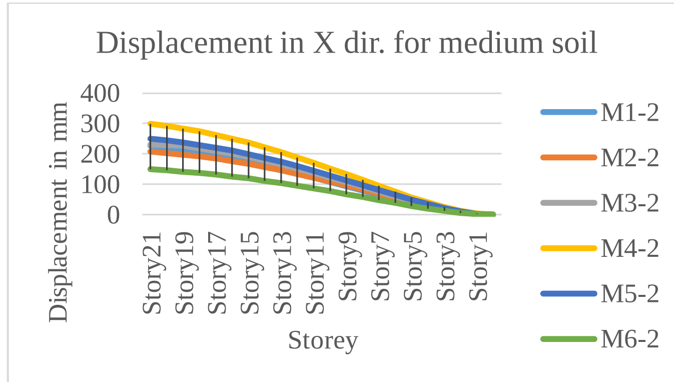


Fig 3 Displacement in X direction for Medium soil

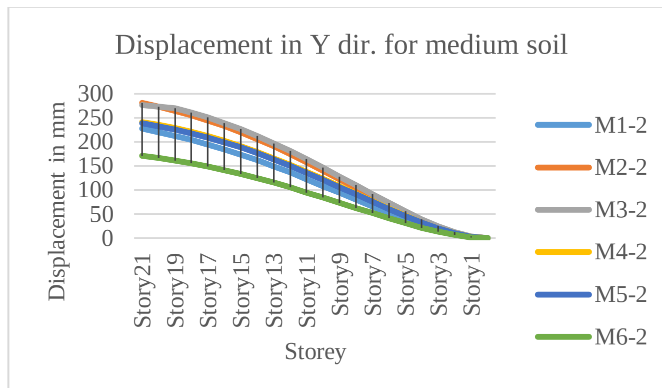


Fig 4 Displacement in Y direction for Medium soil

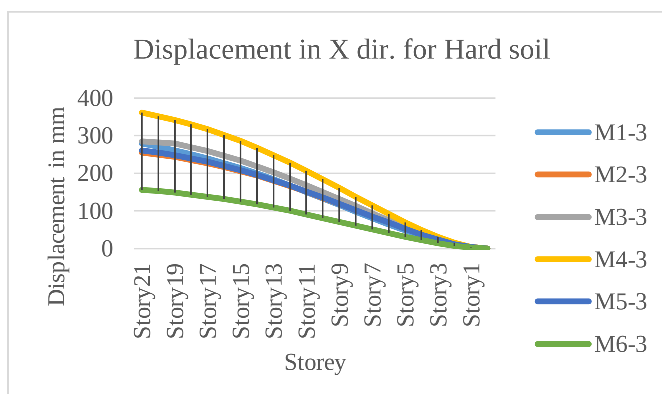


Fig 5 Displacement in X direction for Hard soil

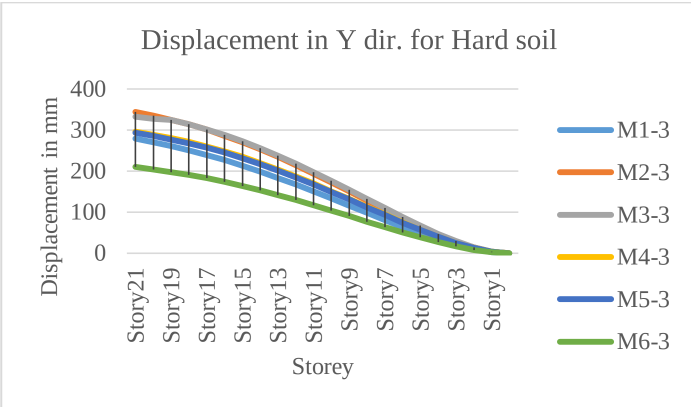


Fig 6 Displacement in Y direction for Hard soil

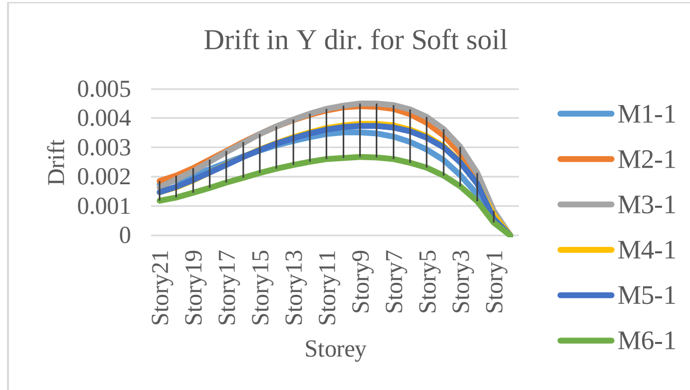


Fig 8 Storey drift in Y direction for Soft soil

B. Results for storey drift:

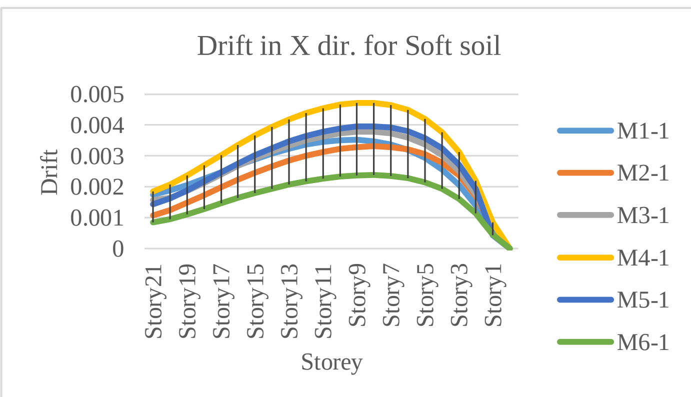


Fig 7 Storey drift in X direction for Soft soil

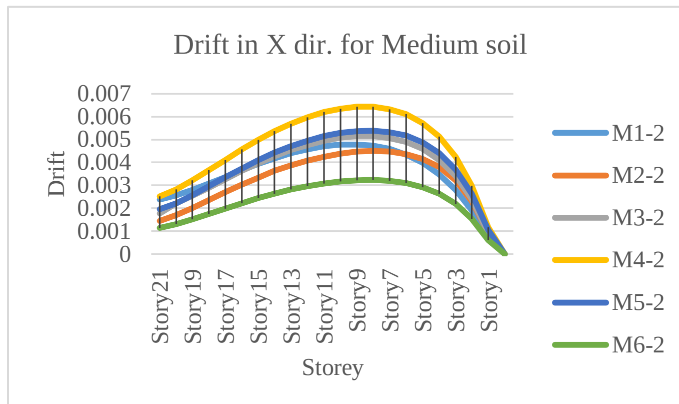


Fig 9 Storey drift in X direction for Medium soil

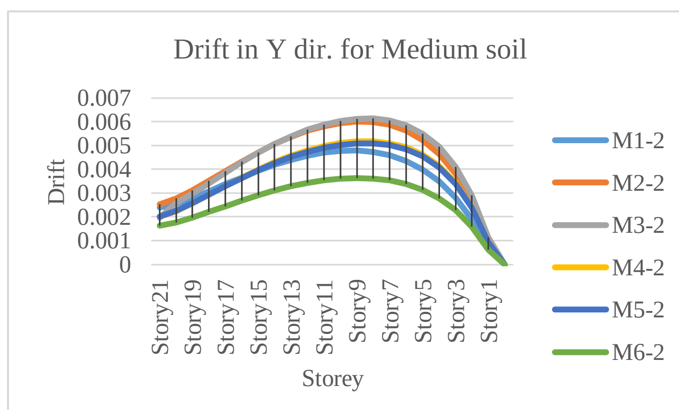


Fig 10 Storey drift in Y direction for Medium soil

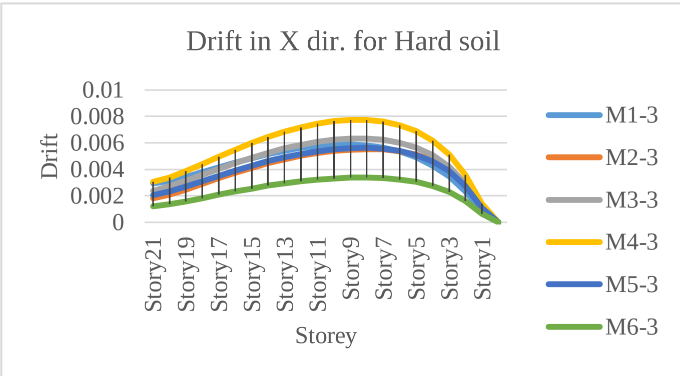


Fig 11 Storey drift in X direction for Hard soil

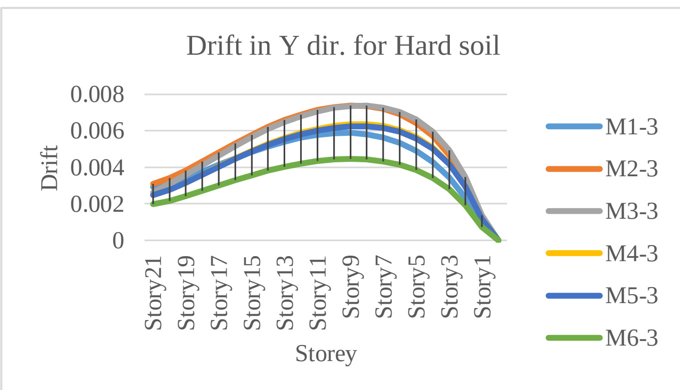


Fig 12 Storey drift in Y direction for Hard soil

C. Results for base shear

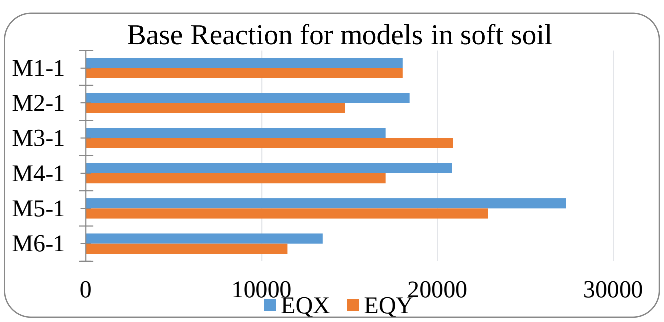


Fig 13 Base Reaction for models in soft soil

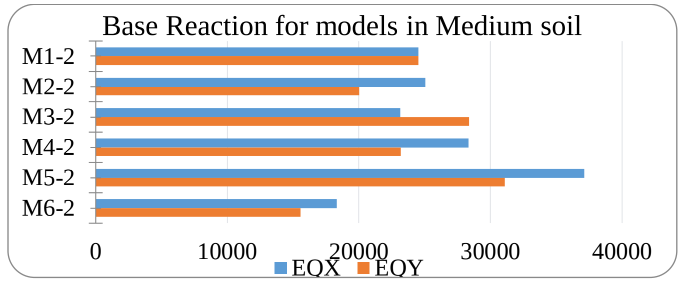


Fig 14 Base Reaction for models in Medium soil

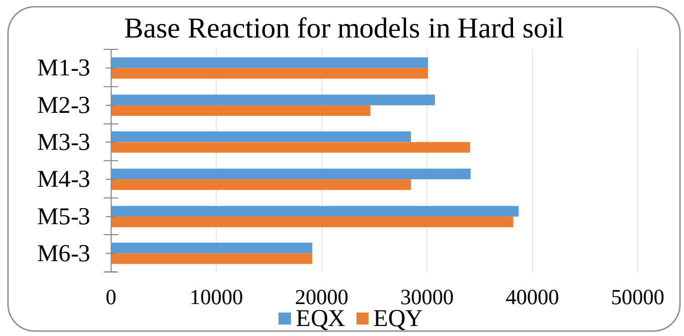


Fig 15 Base Reaction for models in Hard soil

D. Results of Axial Forces in Columns

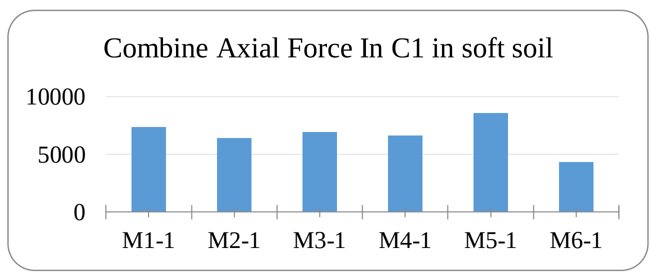


Fig 16 Combined Axial Force in C1 in soft soil

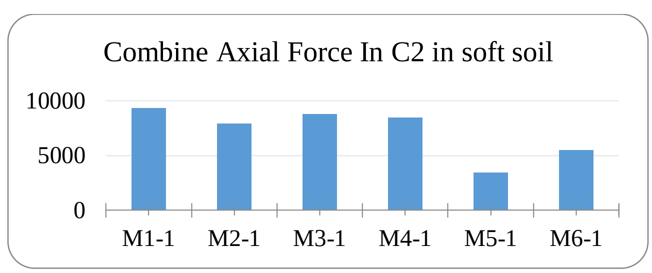


Fig 17 Combined Axial Force in C2 in soft soil

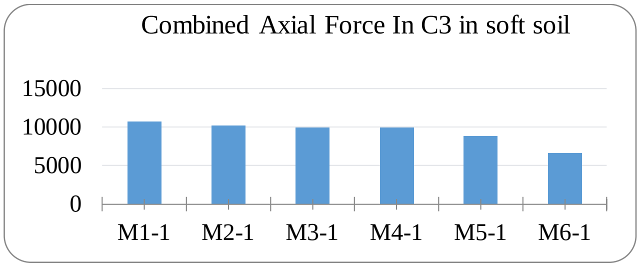


Fig 18 Combined Axial Force in C3 in soft soil

E Results for bending moment in columns:

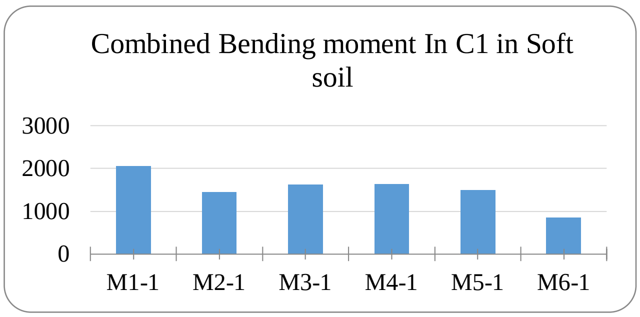


Fig 19 Combined Bending moment In C1 in Soft soil

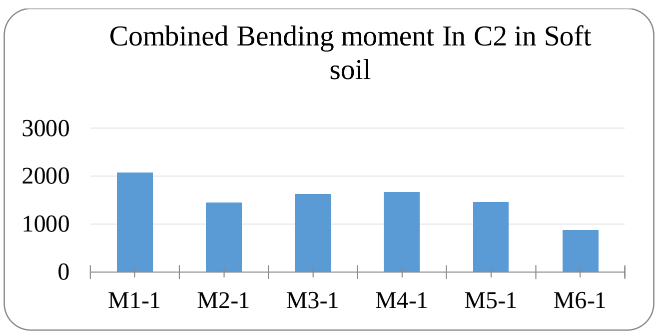


Fig 20 Combined Bending moment In C2 in Soft soil

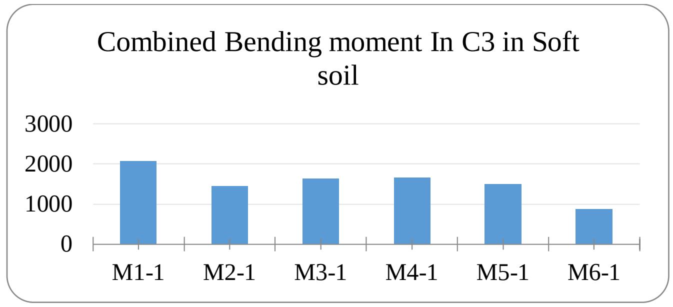


Fig 21 Combined Bending moment In C3 in Soft soil

5. CONCLUSION

- Storey drift is increased up to height of 9th storey reaching to maximum value and then started decreasing.
- Displacement and storey drift is maximum for model-4 in X direction as compared to other models in all type of soils.
- Displacement and storey drift of model-6 is less than other models in both direction in all types of soil.
- Displacement of all models in soft soil are less as compare to displacement in hard and medium soil.
- Square, I-shape and T-shape type buildings give almost similar response against the storey drift and displacement in X- direction.
- Displacement of model M-4 is 220mm in soft soil, 300mm in medium soil and 360mm in hard soil in X-direction.

REFERENCES

[1] Thupden Tashi Lachenpa Bhutia, Dr. Rajendra .S., Vijay .K., "Comparative Study on Seismic Analysis of R.C Structure with Fixed and Spring Base in Different Zones and Soil Types Considering Soil Structure Interaction" International Journal on Recent and Innovation Trends in Computing and Communication, Vol- 4 Issue: 7, July2016.(1)

[2] Ankit Purohit, Lovish Pamecha, "Seismic Analysis of G+12 Multistory Building Varying Zone and Soil Type", SSRG International Journal of Civil Engineering (SSRG-IJCE), vol-D 4 Issue 6, June 2017(2)

[3] Suman, Dr. Sunil, Kumar Tengali, "Soil structure interaction of R. C. building with different foundations and soil types", International Research Journal of Engineering and Technology (IRJET), Vol-04, Issue-07, July-2017. (3)

[4] Mr. Rahul Sawant, Dr. M. N. Bajad, "Effect of Soil-Structure Interaction on High Rise RC Building",Journal of Mechanical and Civil Engineering (IOSR-JMCE), PP 85-91, (Feb 2016) (4)

[5] Ranu R. Akulwar, "Seismic Analysis of Structures under Different Soil Conditions", International Journal of Engineering Research and Applications(IJERA), Vol-5, Issue-1, Jan. 2015, pp.64-69(5)

[6] Akhil R, Aswathy S Kumar, "Seismic analysis of regular and irregular buildings with vertical irregularity using staad.pro", International Research Journal of Engineering and Technology (IRJET), Vol-

a. 04, Issue-06, June -2017(6)

[7] Mamathashree K. S., Sanjay S. J., "Seismic Evaluation of RC Framed Irregular Buildings with Soil Structure Interaction", International Journal of Science and Research (IJSR), Vol-5, Issue-6, June-2016(7)

[8] Veena S. Ravi, Sreedevi Lekshmi, "Effect of Shape and Plan Configuration on Seismic Response of Structure (ZONE II & V)", International Journal of Science and Research (IJSR), Paper ID: ART2016452,(2015) (8)

[9] Milind V. Mohod, "Effect of Shape And Plan Configuration On Seismic Response Of Structure", International Journal Of Scientific & Technology ResearchVolume 4, Issue 09, September 2015. (9)

[10] Haroon Rasheed Tamboli, Umesh. N. Karadi, "Seismic Analysis of R. C. Frame Structure with and without Masonry Infill Walls", Indian Journal Of Natural Sciences, (IJONS), Vol-.3, issue-14,oct.2012.(10)

[11] Ehsan Dehghani Sanij, Dr. Reza Alaghebandian, "Nonlinear earthquake response analysis of R. C. frames with masonry infills", 15 WCEE-2012. (11)

[12] Girum Mindaye, Dr. Shaik Yajdani, "Seismic Analysis of a Multistorey R. C. Frame Building in Different Seismic Zones", International Journal of Innovative Research in Science, Engineering and Technology, (IJIRSET), Vol. 5, Issue 9, September 2016.(12)