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Seismic Analysis of Different Plan Configuration of Multi-Storied Building in Various Types of Soil Using ETABS

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ABSTRACT
ETAB is most precisely software used in market for seismic analysis of multistory building and for design purpose. These project analyzed seismic calculation and design of different plan configuration of multistoried building in various types of soil using ETAB software. These project calculate lateral forces (Q) acting on the structure. The value of zone factor (Z) importance factor (I) response reduction factor (R) and fundamental natural period (Ta) are taken from the region, seismic zone, soil condition structure type and structure type condition. The horizontal and vertical forces are calculated as product of seismic coefficient. The weight of structure (W) is applied to the structure. The stability, deformation, stress, and strain of each structural member are calculated against horizontal and vertical forces by adding vertical load due to weight of the structure for analysis of SF and BM of beam and column ETAB is most precise software. So these project analyzed the comparative seismic study obtain from manual design as per IS 1893: 2016 and ETAB software's. The analysis and design of structure is done and the result obtained from manual design and software are compared and conclusion from them is computed.
Material which have property is linear static and dynamic analysis are performed. These analysis are carried out by considering different Soil parameter. By taking three different types of soils namely Hard, Medium and Soft .Different response like story drift, displacements base shear are plotted for different zones and different types of soils.
Keywords: seismic analysis, ETAB software, displacements, base shear'

I. INTRODUCTION

For producing a structure capable of resisting all applied load without failure during its intended life need structural analysis and design. Site investigation is process of collect information and evaluating condition of site for the purpose of designing and constructing the foundation a site for the purpose of designing and constructing foundation for a structure. Structural engineering are facing challenging for doing most economical design with accuracy in solution over its design life time. So, in now days there are no of software available for analyzing and designing practically act structural forces ETABS, STAADPRO, SAP AND RAM etc. Many design companies use these software for their project design purpose so, these project analyzed the result

obtained between comparative seismic analysis of multistoried using manually design and ETAB software separately.

The height of each story is taken as 3.1 m. making total height of structure 31 m. for another case structure is modeled using IS 1893 and ETAB software. Design of structures for earthquakes is different from that for any other natural phenomenon, like wind and wave. An earthquake to impose displacement on the structure, while winds and waves apply force on it. The displacement imposed at the base of the structure during an earthquake causes inertia forces developed at base of structure which are responsible for destroyed in the structure. From the analysis. More the mass of structure, the higher is the inertia force. Design of structures for earthquakes is different from that for any other natural phenomenon, like wind and wave. An earthquake imposes displacement on the structure, while winds and waves apply force on it. The displacement imposed at the base of the structure during an earthquake causes inertia forces to be generated in it, which are responsible for damage in the structure. As a consequence of this, the mass of the structure being designed assumes importance; the more the mass, the higher is the inertia force.

Hence our project aims Seismic analysis and design of different plan configuration of multi- storeyed building in various types of soil using ETAAB

II. LITERATURE REVIEW

Balaji.U and Selvarasan M.E (2016) worked on analysis and design of multi-storeyed building under static and dynamic loading conditions using ETABS. In this work a G+13 storey residential building was studied for the earth quake loads using ETABS. They assumed that material property to be linear, static and dynamic analyses were performed. The non-linear analysis was carried out by considering severe seismic zones and the behaviour was assessed by considering type II soil condition. Different results like displacements, base shear were plotted and studied.

Geethu(2016) made a comparative study on analysis and design of multi storied building by STAAD.Pro and ETABS softwares. They provided the details of both residential and commercial building design. The planning was made in accordance with the national building code and drafted using Auto CAD software. They concluded that while comparing both software results, ETABS software shows higher values of bending moment and axial force.

Chandrashekar(2015) analyzed and designed the multi-storeyed building by using ETABS software. A G+5 storey building under the lateral loading effect of wind and earthquake was considered for this study and analysis is done by using ETABS. They have also considered the chances of occurrence of spread of fire and the importance of use of fire proof material up to highest possible standards of performance as well as reliability. They suggested that the wide chances of ETABS software which is very innovative and easier for high rise buildings so that time incurred for designing is reduced.

Varalakshmi V (2014) analyzed a G+5 storey residential building and designed the various components like beam, slab, column and foundation. The loads namely dead load and live load were calculated as per IS 875(Part I & II)-1987 and HYSD bars i.e. Fe 415 are used as per IS 1986-1985. They concluded that the safety of the reinforced concrete building depends upon the initial architectural and structural configuration of the total building, the quality of the structural analysis, design and reinforcement detailing of the building frame to achieve stability of elements and their ductile performance.

B. Srikanth and V. Ramesh (2013) comparative study of seismic response for seismic coefficient and response spectrum methods. In this thesis, the earthquake response of symmetric multi-storied building by two methods are studied. The methods include seismic coefficient method as recommended by IS Code and modal analysis using response spectrum method of IS Code in which the stiffness matrix of the building corresponding to the dynamic degrees of freedom is generated by idealizing the building as shear building. The responses obtained by above methods in two extreme zones as mentioned in IS code i.e. zone II and V are then compared. Test results Base Shears, Lateral Forces and Storey Moments are compared.

Mayuri D. Bhagwat In this work dynamic analysis of G+12 multistoried practiced RCC building considering for Koyna and Bhuj earthquake is carried out by time history analysis and response spectrum analysis and seismic responses of such building are comparatively studied and modeled with the help of ETABS software. Two time histories (i.e. Koyna and Bhuj) have been used to develop different acceptable criteria (base shear, storey displacement, storey drifts).

Wakchaure M.Rhas investigated that study the effect of masonry walls on high rise building. Linear dynamic analysis is done on high rise building with different arrangement is carried out. Analysis is done on G+9 R.C.C. framed building. Earthquake time history is applieds to the models. Equivalent strut method is used to calculate the width of strut. Various cases of analysis are taken. Analysis is carried out by software ETABS. Base shear, storey displacement, story drift is calculated and all models are compared.

L.G.Kalurkar The design and analysis of multistoried G+5 building using composite structure at earthquake zone-3. A three dimensional modeling and analysis of the structure are carried out with the help of ETAB software. Equivalent Static Method of Analysis and Response spectrum analysis method are used for the analysis of both Composite and RCC structures. The results are compared and found that composite structure more economical.

Mohammed Rizwan Sultan (2015)The most important objective of this study is to grasp the behaviour of the structure in high seismic zone and also to evaluate Storey overturning moment, Storey Drift, Displacement, Design lateral forces. During this purpose a 15 storey-high building on four totally different shapes like Rectangular, L-shape, H-shape, and C-shape are used as a comparison. The complete models were analysed with the assistance of ETABS 9.7.1 version. In the present study, Comparative Dynamic Analysis for all four cases have been investigated to evaluate the deformation of the structure. Results & Conclusion: The results indicates that, building with severe irregularity produces more deformation than those with less irregularity particularly in high seismic zones. And conjointly the storey overturning moment varies inversely with height of the storey. The storey base shear for regular building is highest compare to irregular shape buildings.

III.METHODOLOGY

The project aims at comparative study on seismic analysis and design of R.C.C Moment Resisting Space Frame has analysed and designed ETAAB Software referring IS:456, IS:1893 Part-I (2002) and detailing is made according to IS:13920-1993. Various methods of seismic analysis

To achieve the objectives of the study that is to analyse and design commercial building using ETABS and by manual method, which meets the basic requirements such as safety, durability, economy, aesthetic appearance, feasibility, practicability and acceptability. It has been proposed to follow the following methodology.

- Finalization of plan with different configuration.
- Analysis & design manually for validation.

- Design different plan configuration by using ETAB software.
- Compare result obtained by manually and software design.
- Compare result obtained by different plan configuration.

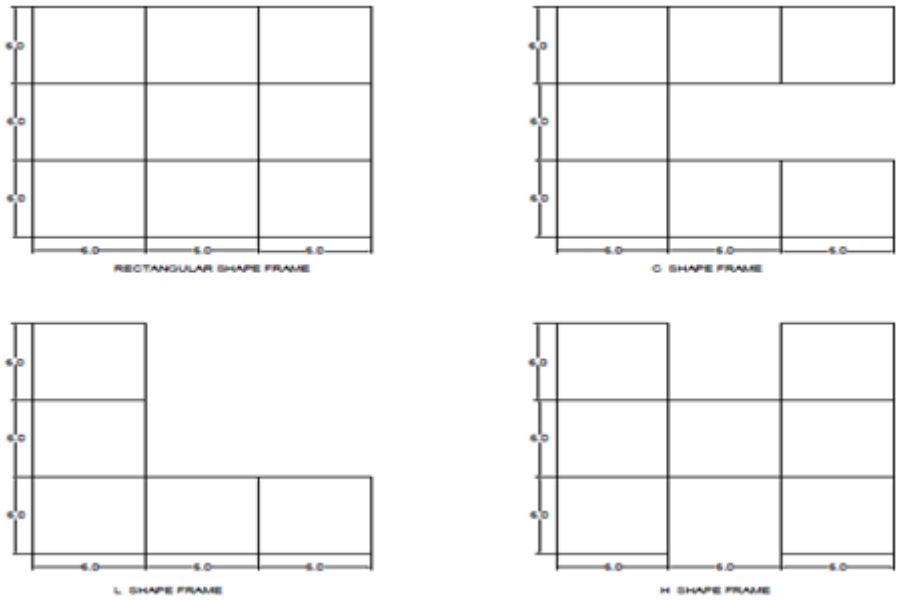

Figure1:Finalization Of Plan With Different Configuration.

IV. RESULT AND ANALYSIS

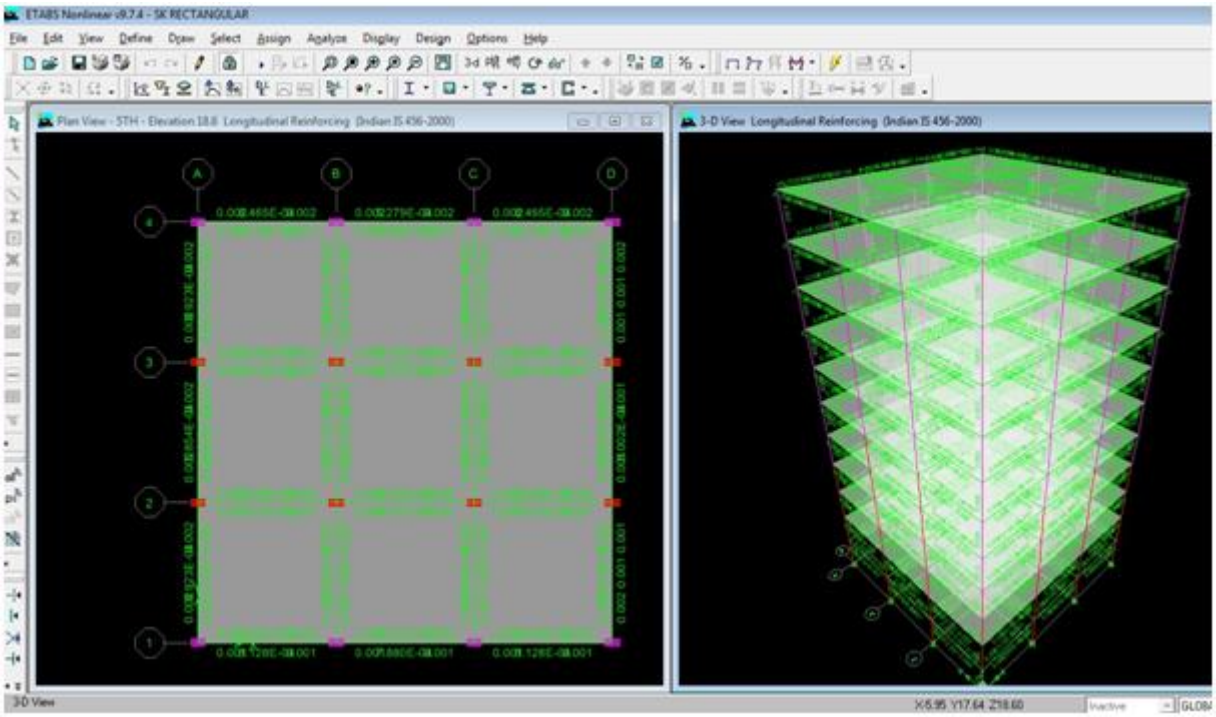

Figure2:Rectangular Frame

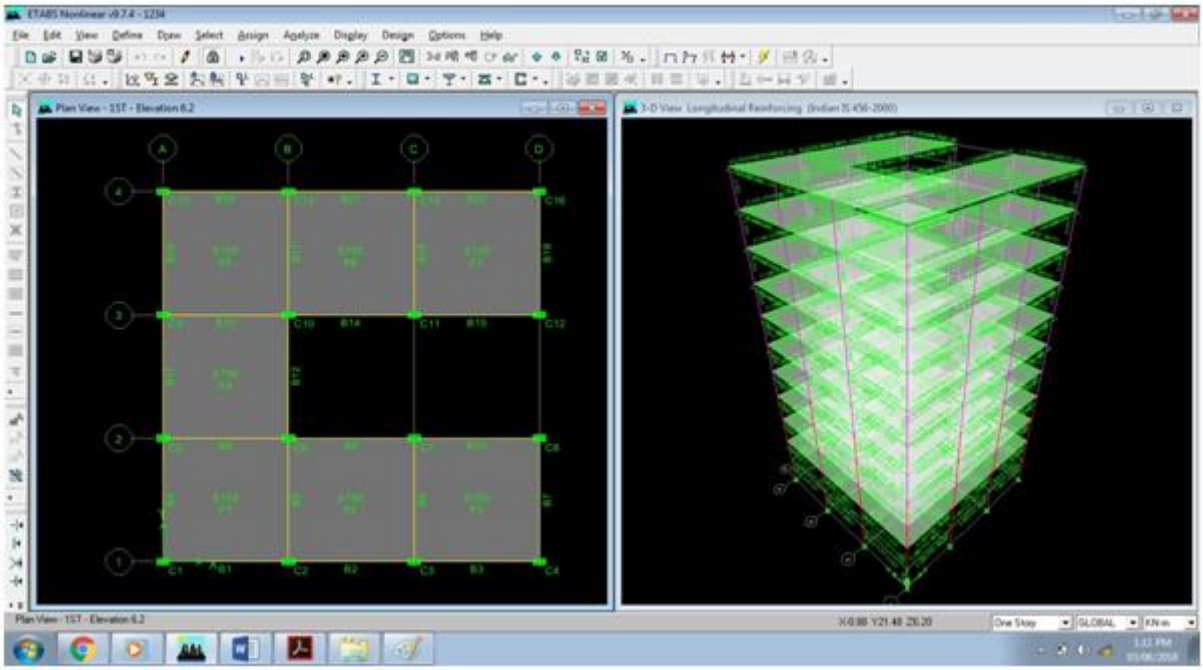

Figure3:C - FRAME

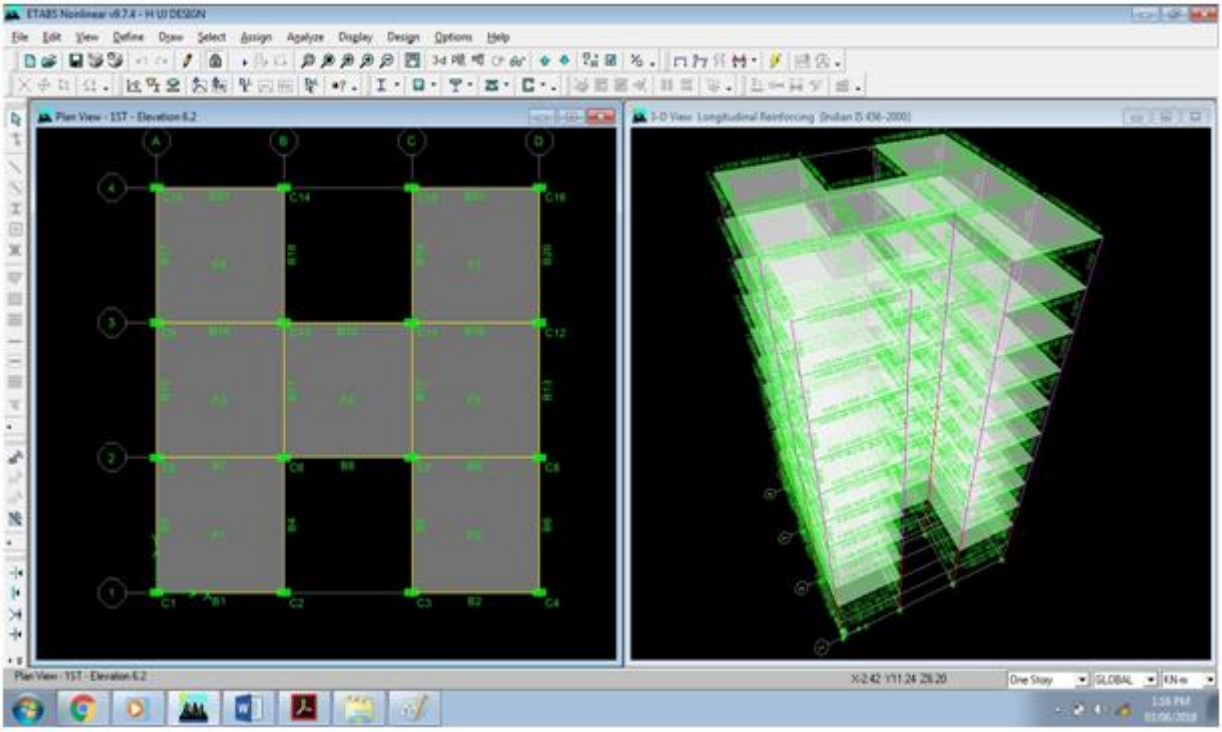

Figure4:H – FRAME

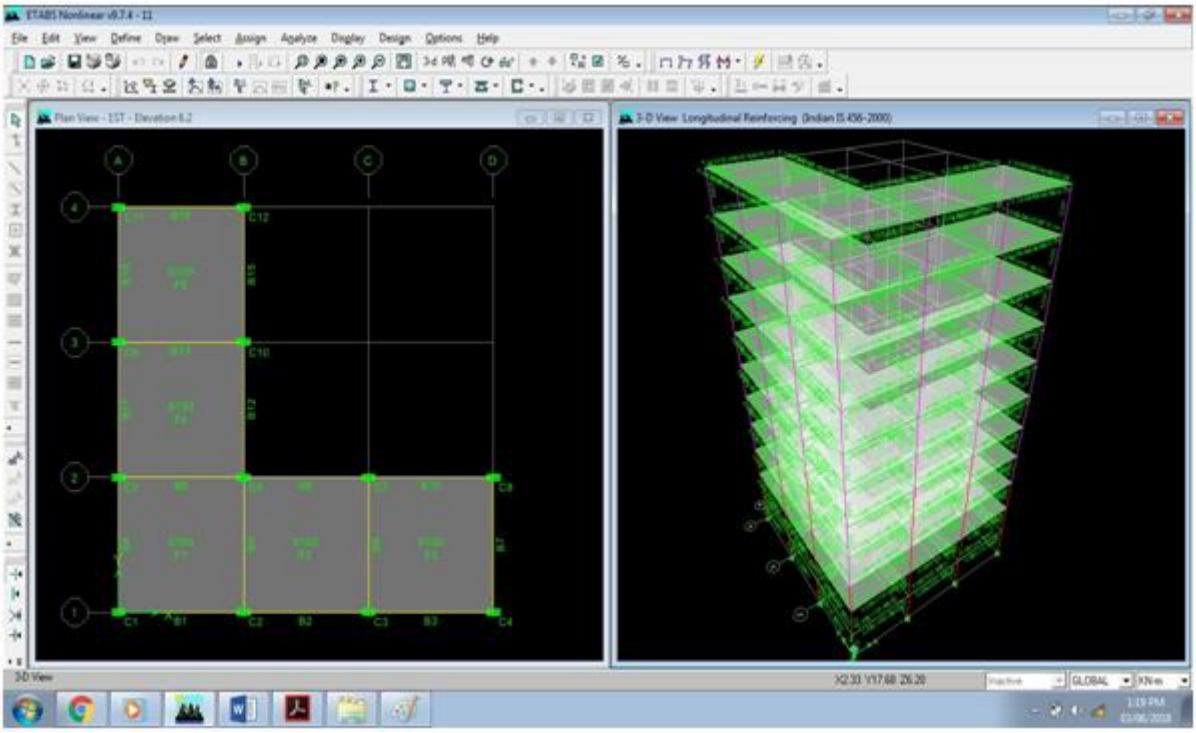

Figure5:L – FRAME

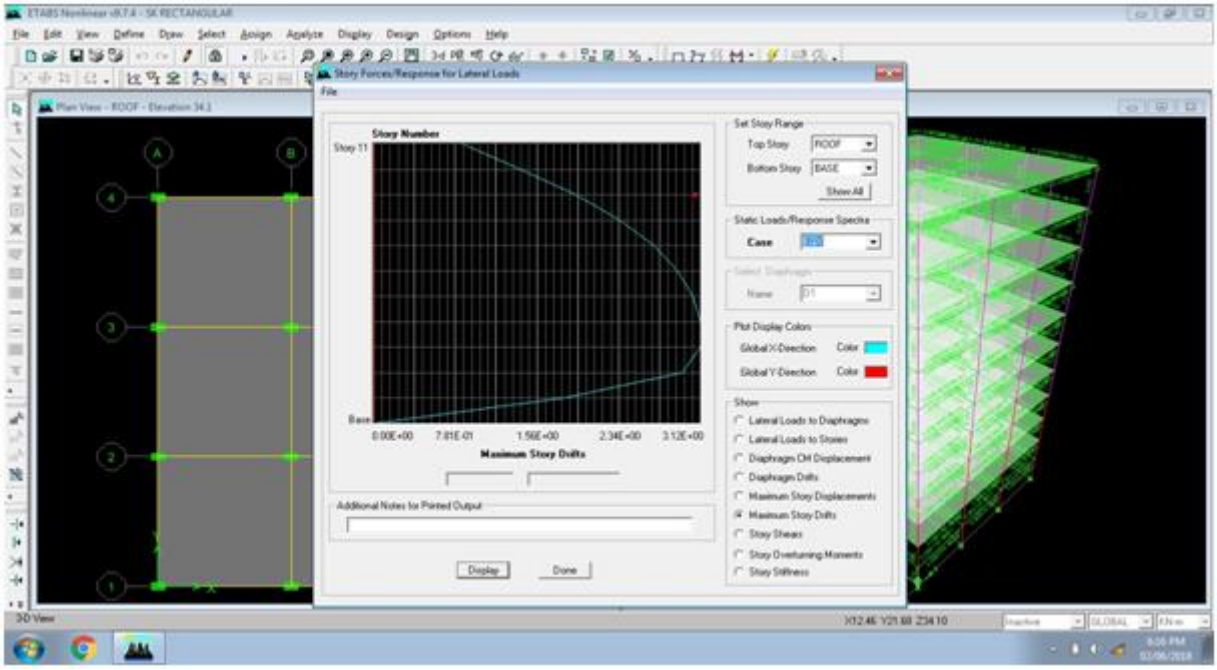

Figure6:Maximum story drift for Rectangular frame – EQX Graph

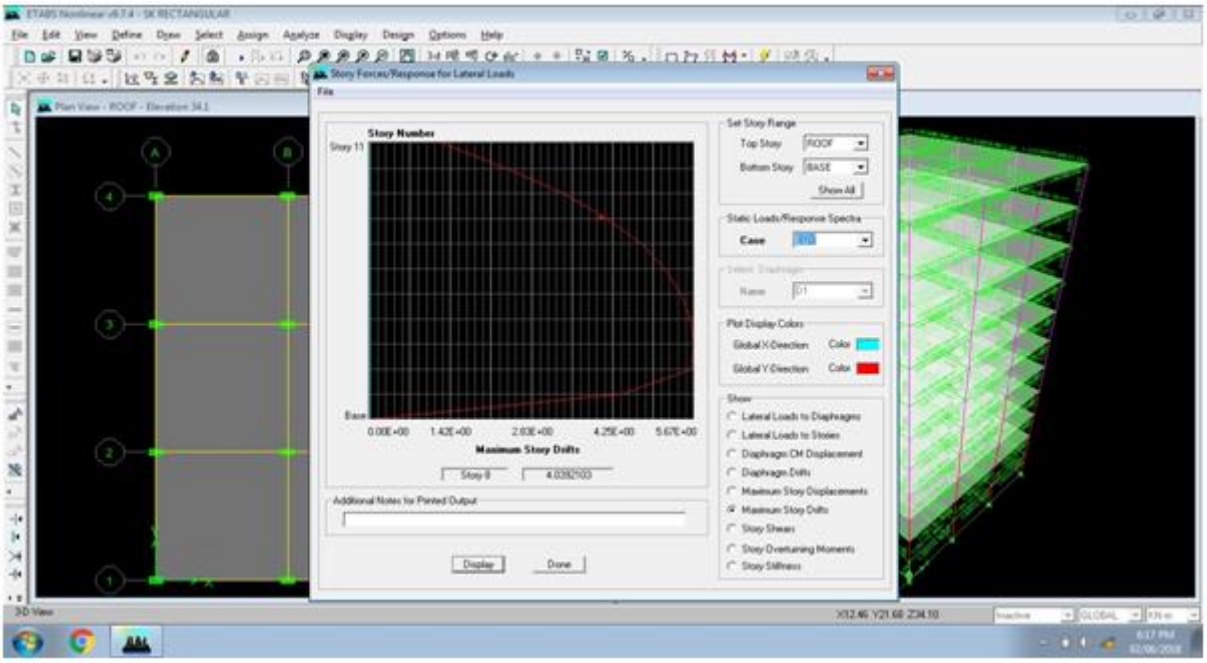

Figure7:Maximum story drift for Rectangular frame – EQY Graph

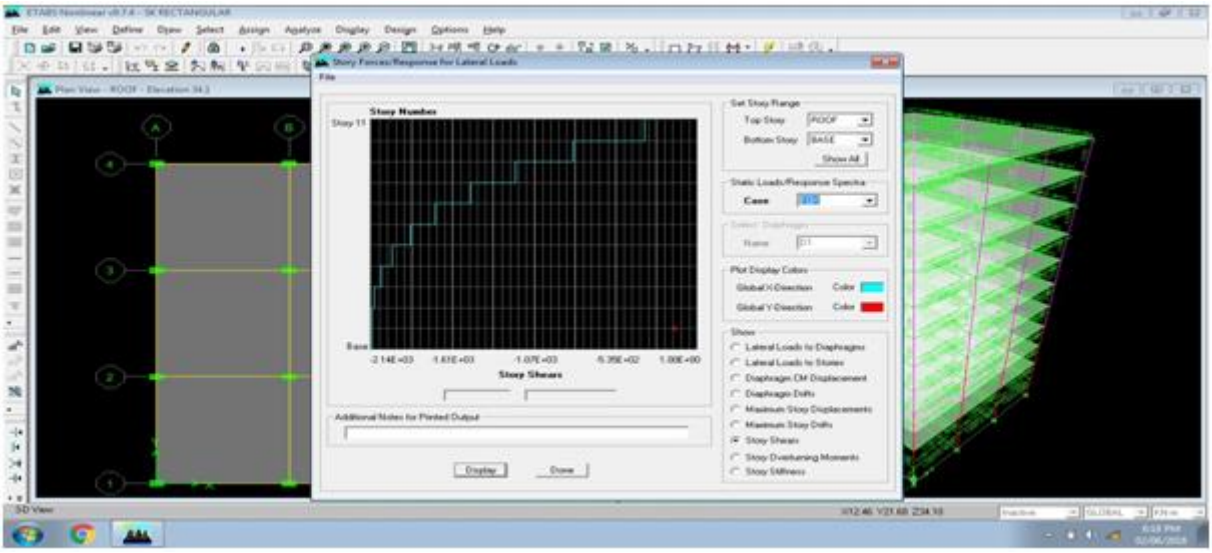

Figure8:Story Shear for Rectangular frame – EQX Graph

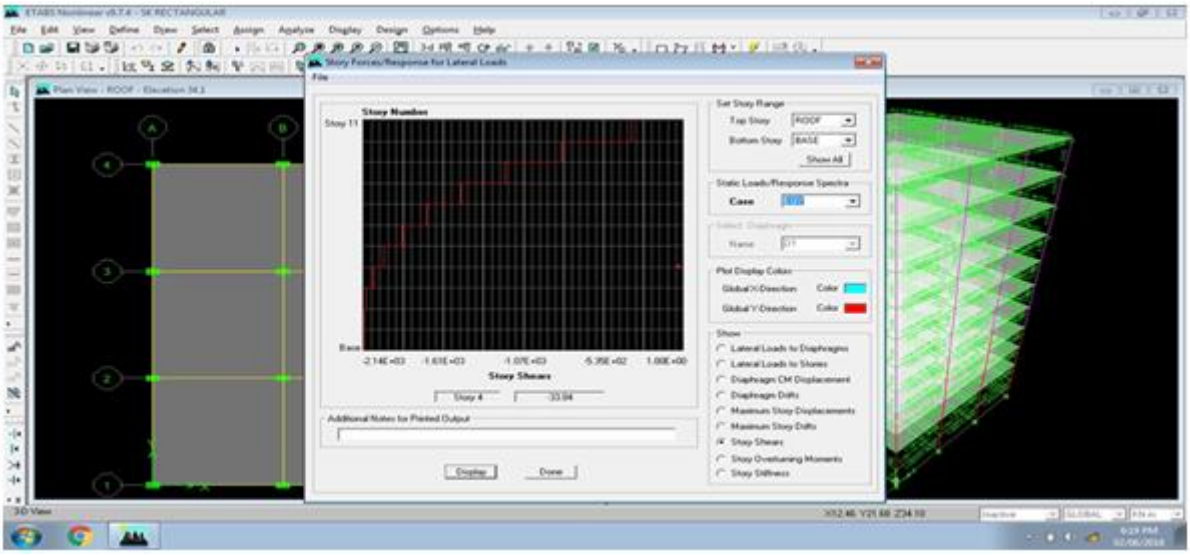

Figure9:Story Shear for Rectangular frame – EQY Graph

TABLE I COMPARISON OF RESULTS OBTAINED BY ETABS SOFTWARE FOR DIFFERENT PLAN CONFIGURATION: FOR STORY DRIFT (FOR DRIFT X)

FloorNo.	RectangularModel(M1)	H-Model(M2)	L-Model(M3)	C-Model(M4)
Roof	0.848186	1.072405	1.253884	0.739860
9th	1.409269	1.610242	1.759169	1.227517
8th	1.934563	2.119215	2.259814	1.683702
7th	2.356300	2.528448	2.662096	2.050108
6th	2.675342	2.833478	2.958033	2.327333
5th	2.902063	3.042988	3.155672	2.524358
4th	3.048416	3.167624	3.265199	2.651567
3rd	3.124196	3.215668	3.294504	2.717484
2nd	3.123220	3.178053	3.233706	2.716770
1st	2.942870	2.957159	2.943547	2.560105
Parking	1.831598	1.781286	1.679696	1.593485

V. CONCLUSION

- Seismic behaviour of the beam column junction RC moment resisting frame is carried out, but study on RCC moment resisting frame for various seismic zones and for different soil parameters.
- In the proposed work a RCC moment resisting frame is analysed and designed using ETAB for different seismic parameters and optimum design for zones by varying seismic soil parameters is do.
- It has been observed that the higher values obtained by base shear and top storey displacement.
- Analysis was done by using ETABS software and successfully verified manually as per IS 1893-2016.
- Usage of ETABS software minimizes the time required for analysis and design.

VI. REFERENCES

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