Comparative Analysis and Design of Flat and Grid Slab System with Conventional Slab System by using Etabs software

Vicky W. Kamthe[1], Prof. Girish Sawai[2]
[1]MTech Scholar, Structural Engineering, V M Institute of Engineering & Technology, Nagpur, Maharashtra, India

[2]Head of the department, Structural Engineering, V M Institute of Engineering & Technology, Nagpur, Maharashtra, India

ABSTRACT

In the present day, Structural Engineering is a branch of Civil Engineering in which the look at is done to recognize how the structure behave while building is constructed at real environment and to perceive the numerous forces like axial force and shear force, maximum storey displacement, storey stiffness, lateral loads and storey drifts for grid slab and flat slab with conventional system. When the analysis come to complicated structure or multistorey structure the guide calculation will be hard to carry out and subsequently there is diverse software available to carry out those calculations, this software program are STAAD Pro V8i, ANSYS, ETAB, Safe and so forth. In this examine, slab machine layout and evaluation for G+10 building for seismic zone III and having medium soil situation by the usage of ETABS.Four and those slab gadget analysed for one of a kind plan location or grid length/ spacing of the column. The evaluation and layout of slab system is finished as per IS 456-2000 and IS 1893-2002. In the present work the comparison of Conventional building and Flat slab without Drop in different zones, using ETABS software. Therefore, Grid slab, Flat slab, and Conventional RC frame building seismic behaviour characteristics are used to guide the concept and design of these structures, as well as to improve the performance of buildings during seismic loading.

Keywords: *Storey displacement, storey stiffness, Grid slab, flat slab, ETabs.*

I. INTRODUCTION

In Urban areas due to a lack of space in urban areas, vertical development such as low-rise, medium-rise, and towering structures has emerged. Frame structures such as conventional RC frame structures and flat slab frame structures are used in these diverse types of buildings. A conventional RC frame structure has a conventional slab for construction, which is a system that supports a slab using beams and columns. It's known as the Beam–Slab Load Transfer method, and it's a formula that's used all around the world. Structure has a flat slab arrangement in which the beam is utilised in traditional building processes through away with the directly rests on column and the load from the slabs is directly passed to the columns and then 2 to the footing. Column heads or capitals are commonly used to create drops or columns. Flat slabs are commonly utilised in office buildings due to their low formwork costs, quick excavation, and ease of installation. Grid floor systems are monolithic with slab and consist of beams that move apart at regular intervals in perpendicular directions. Grids on the Slab Interconnected grid systems are widely used to support building floors, bridge decks, and above-ground storage tank slabs. A grid is a square and rectangle-based planar structural system.

II. METHODOLOGY

A RCC structure is made up of beam, column, slab, and foundation, which work together as a single unit to distribute load to the footing. The normal load flow in a building is from the slab to the beam, the beam to the column, and ultimately the column to the footing. We used the ETABS software to create different types of flooring for different grid sizes in the current study. Conventional slab, flat slab, and grid slab with the same elevation are the three types of floors used.

Assumption to be followed in work:-

1.The representation of maximum response of idealized single degree freedom system having certain period and damping, during earthquake ground motions.
2. The Buildings are assumed to be in Zone-III.

3.Analysis of Floors using ETABS 2016.

4. The buildings are being designed as per IS 456:2000 & IS 1893:2016.

III. MODELING AND ANALYSIS

In ETABS software to assess the dynamic response of a flat slab without drop it will be modelled and analysed and a standard reinforced concrete framed structure for varied heights in seismic zone III. The structure will be subjected to a linear dynamic response spectrum analysis. Building configuration, loading data and earthquake data

TABLE 1. DESIGN DATA OF BUILDING

Sr.No.	**Specifications**	**Different types of slab system**		
		Conventi -onal Slab	**Flat Slab**	**Grid Slab**
1	Plan Dimension	30 X 30	30 X 30	30 X 30
2	Length of Grid in x- direction	5 m	5m	5m
3	Length of Grid in z- direction	6m	6m	6m
4	Floor to Floor height	3m	3m	3m
5	No. of Stories	10	10	10
6	Plinth Level	1.5	1.5	1.5
7	Slab Thickness	150mm	150mm	150mm
8	Size of Beam	300 x 500		300 x 500
9	Size of Column	450x600	600x600	450x600
10	Grade of Concrete	M45	M45	M45
11	Grade of Steel	Fe415	Fe415	Fe415

TABLE 2. EARTHQUAKE DATA OF BUILDING

Live Load	a) On Roof = 1.5 b) On Floor= 3
Floor Finish	**1.5** kN/m^2
Earthquake data	Zone III (Type II medium soil) Importance factor = 1.2 Response reduction factor = 5 Seismic Zone Factor, Z = 0.16

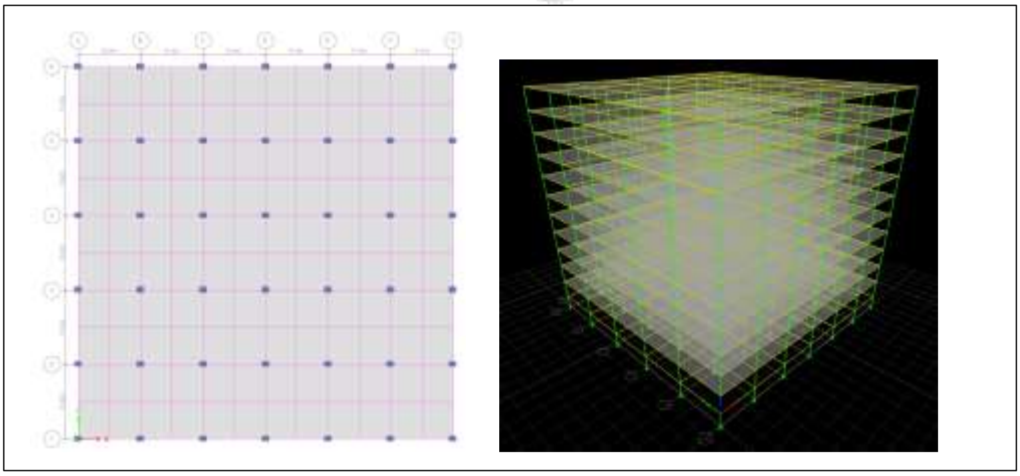

Fig 1 – G+10 (2D+3D) MODEL STRUCTURE AFTER ANALYSIS IN ETABS

IV. RESULTS AND DISCUSSION

1. Graphical Representation of G+10 Multistorey Building in Grid Slab System

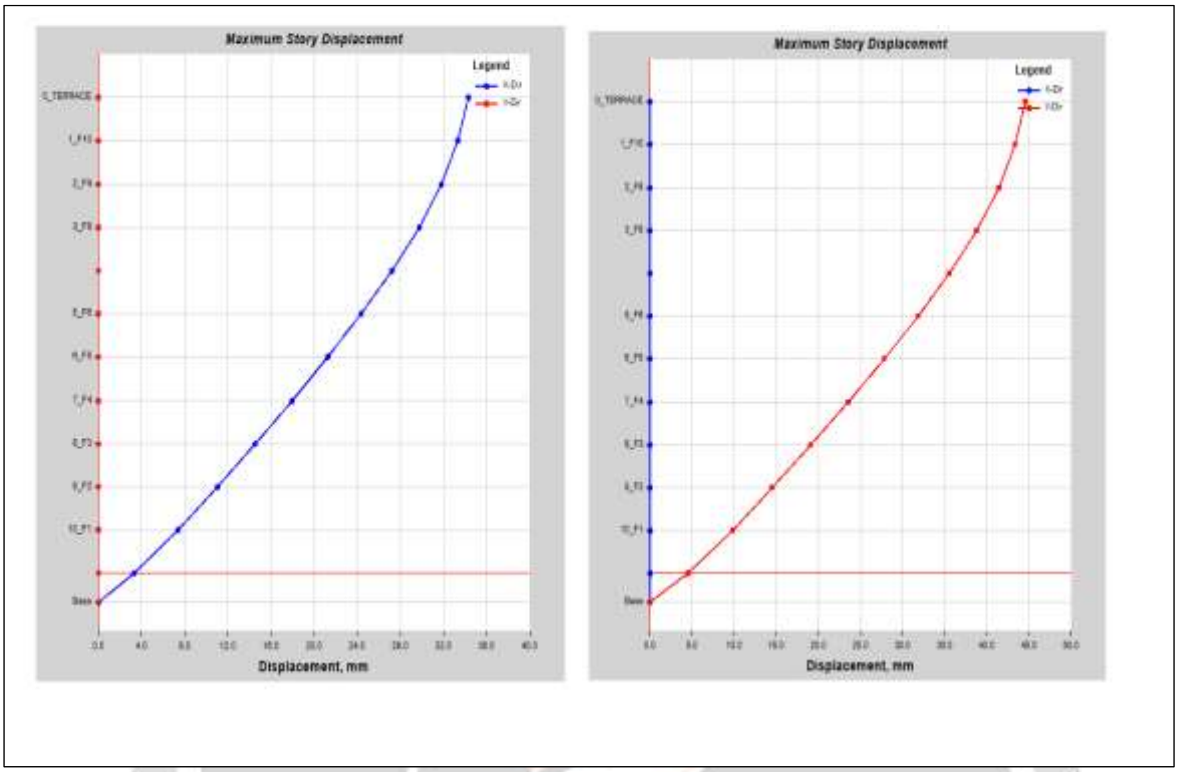

Fig.Graph 1.Maximum story Displacement at X and Y direction Due to load EQx and EQy

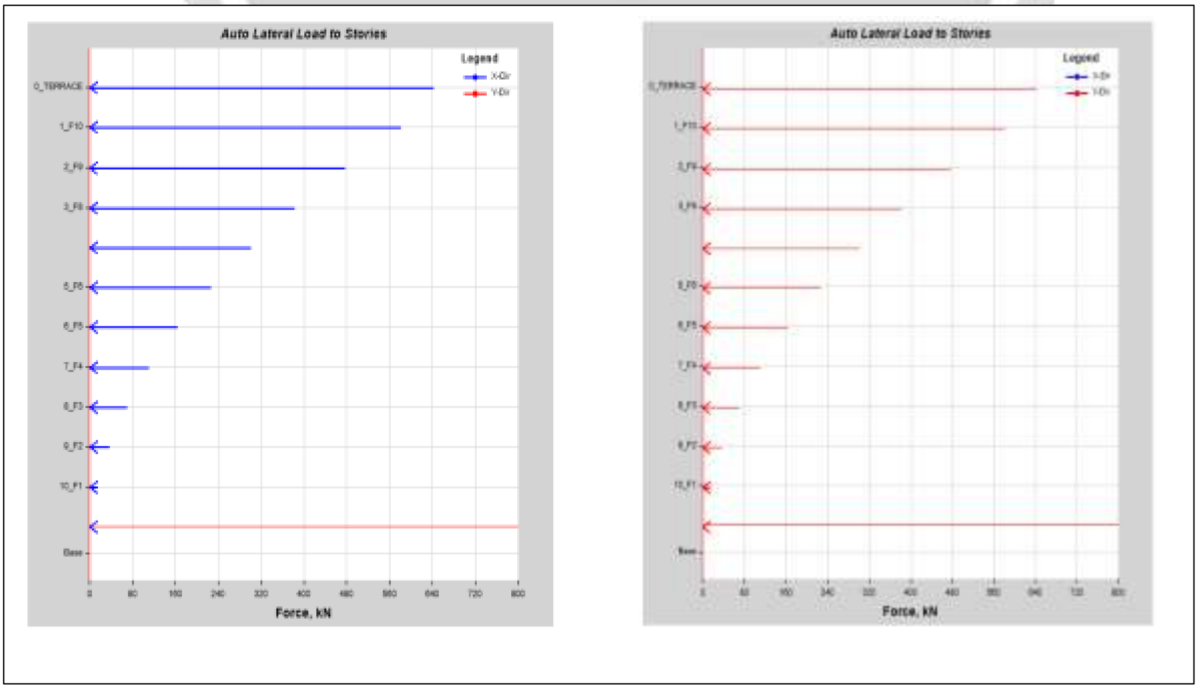

Fig.Graph 2. Lateral Loads at X and Y direction Due to load EQx and EQy

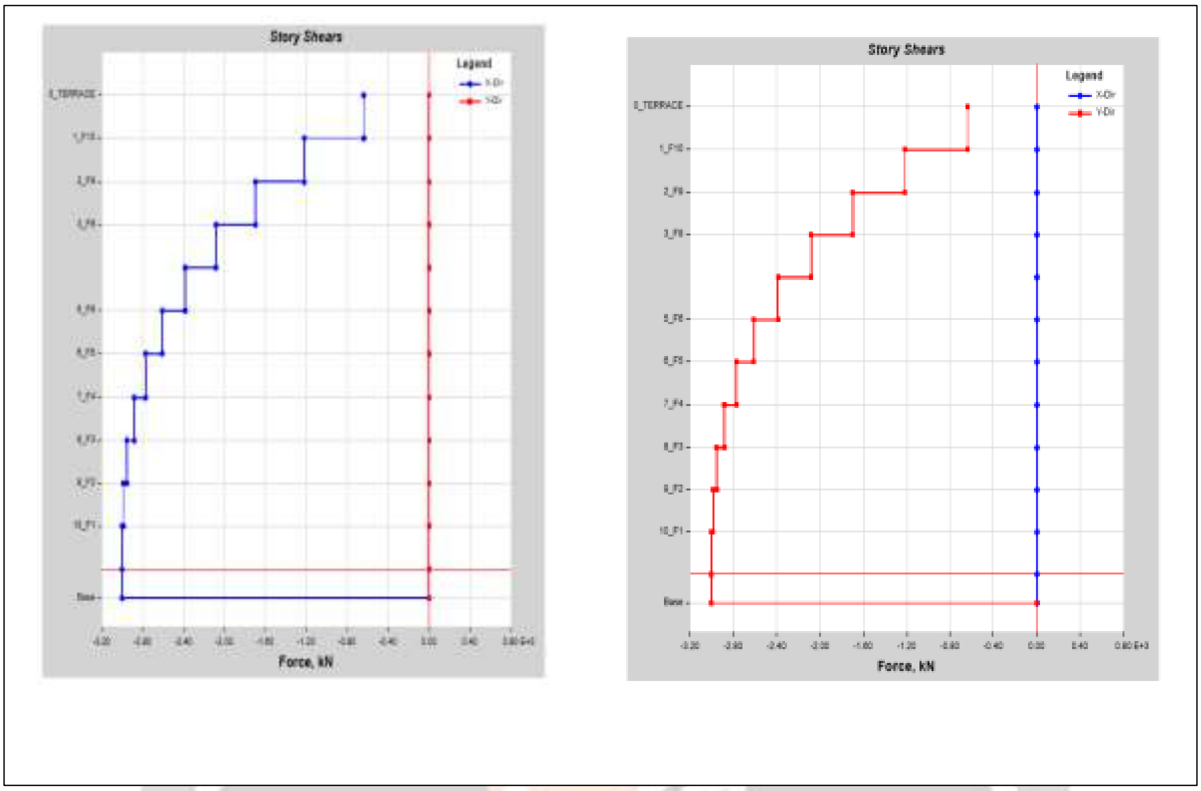

Fig.Graph 3. Story Shear at X and Y direction Due to load EQx and EQy

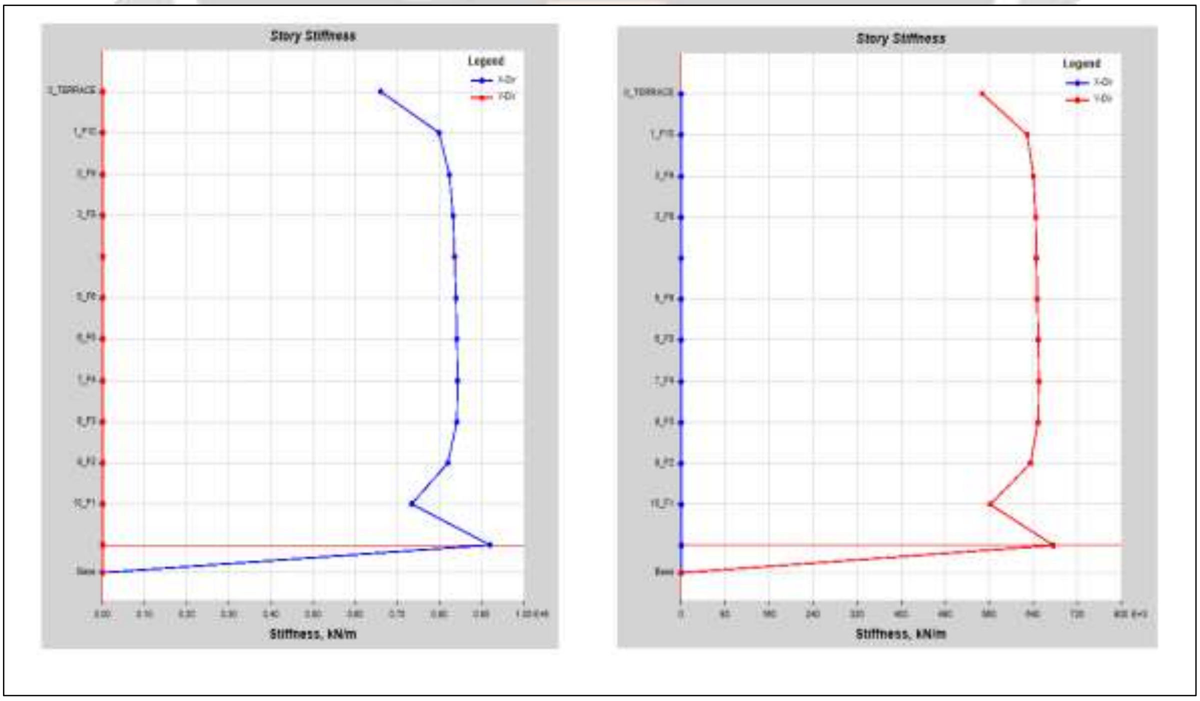

Fig.Graph 4. Story Stiffness at X and Y direction Due to load EQx and EQy

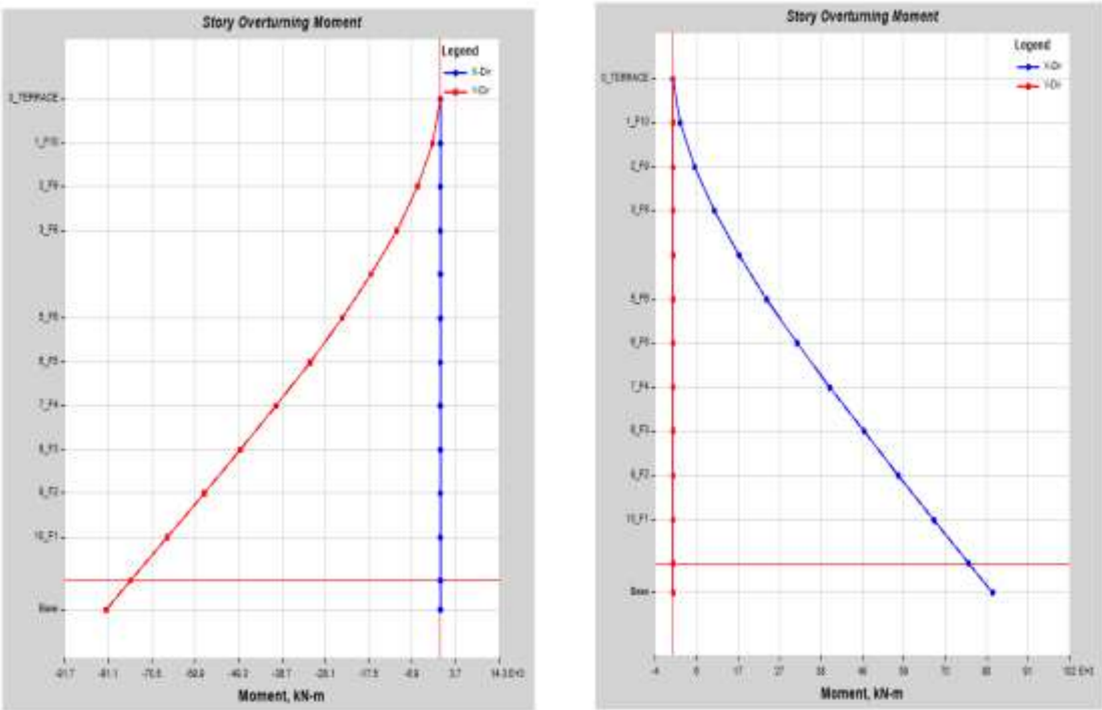

Fig.Graph 5. Story Moments at X and Y direction Due to load EQx and EQy

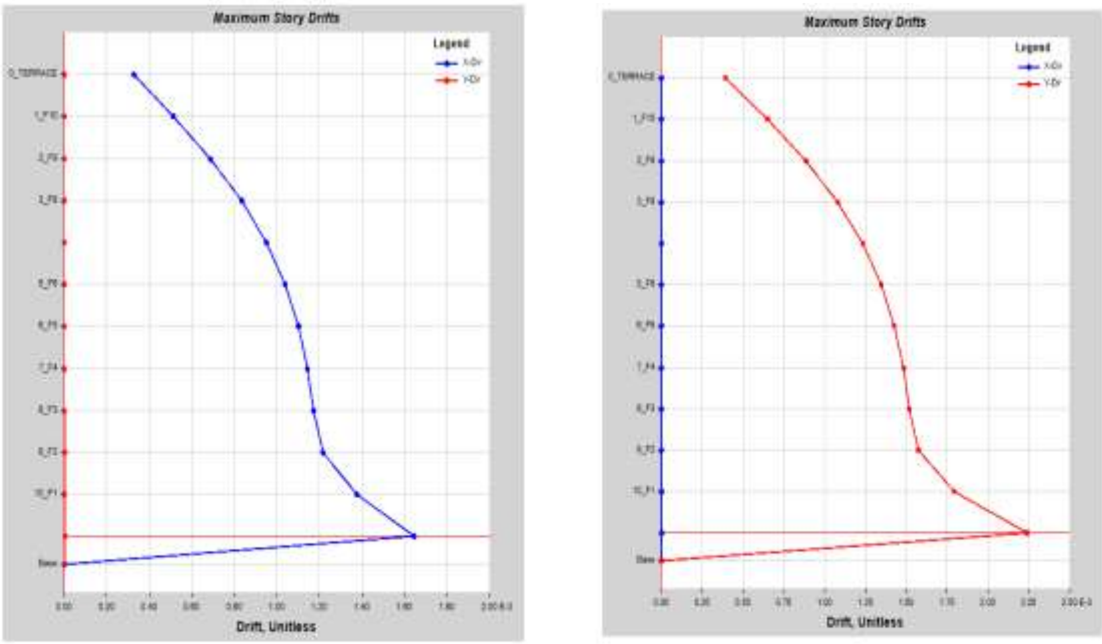

Fig.Graph 6. Story Drifts at X and Y direction Due to load EQx and EQy

2. Graphical Representation of G+10 Multistorey Building in Flat Slab System:

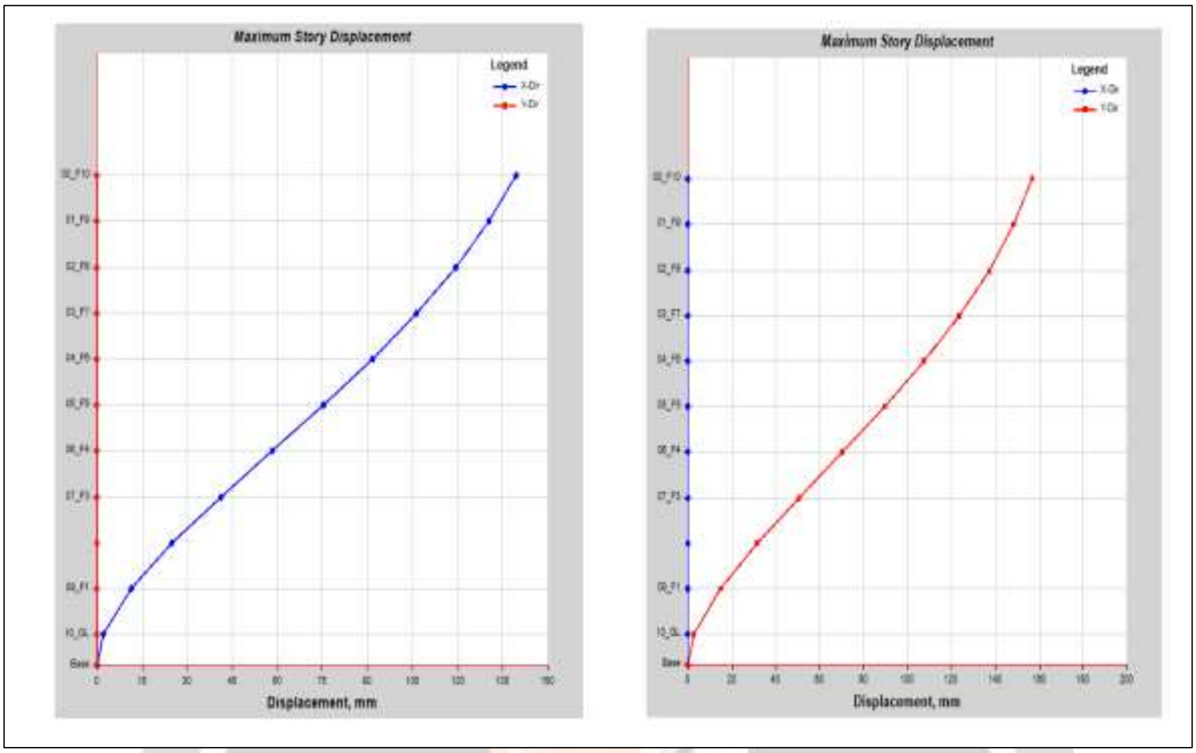

Fig.Graph 7. Maximum story Displacement at X and Y direction Due to load EQx and EQy

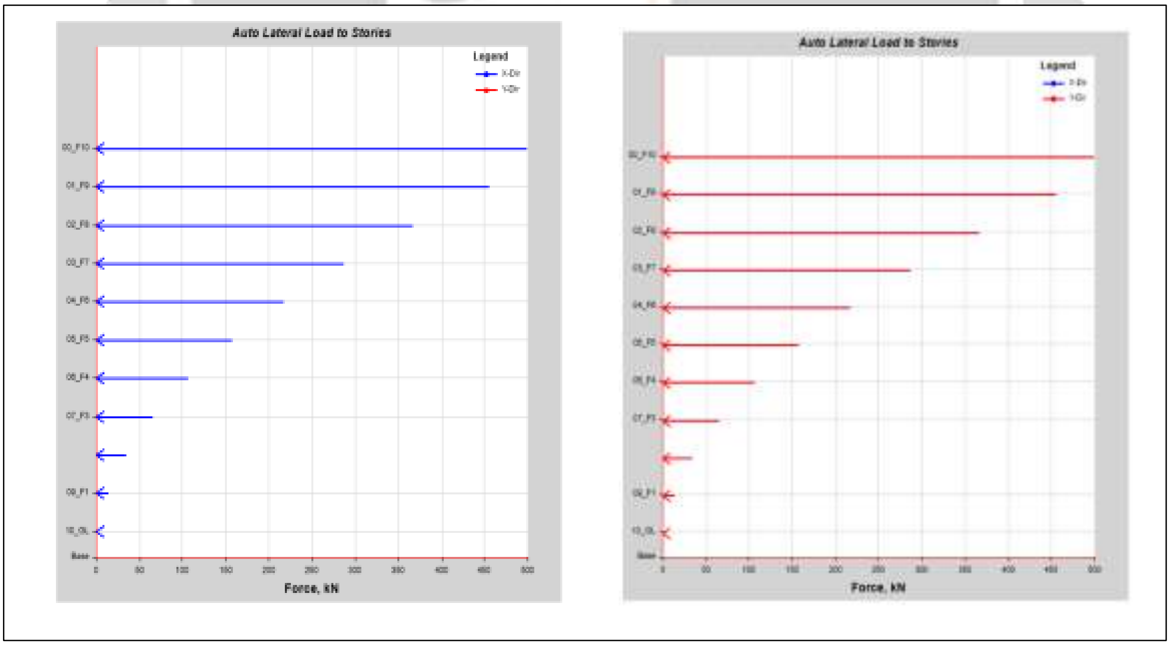

Fig.Graph 8. Lateral Loads at X and Y direction Due to load EQx and EQy

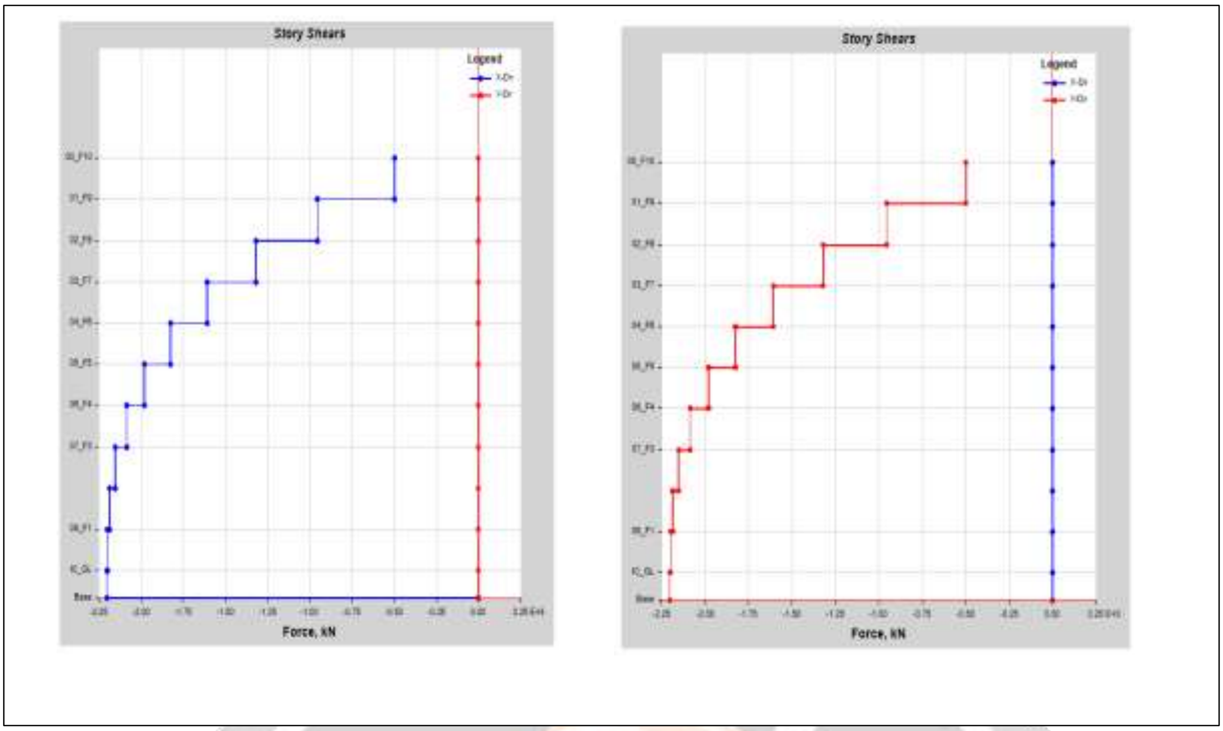

Fig.Graph 9. Story Shear at X and Y direction Due to load EQx and EQy

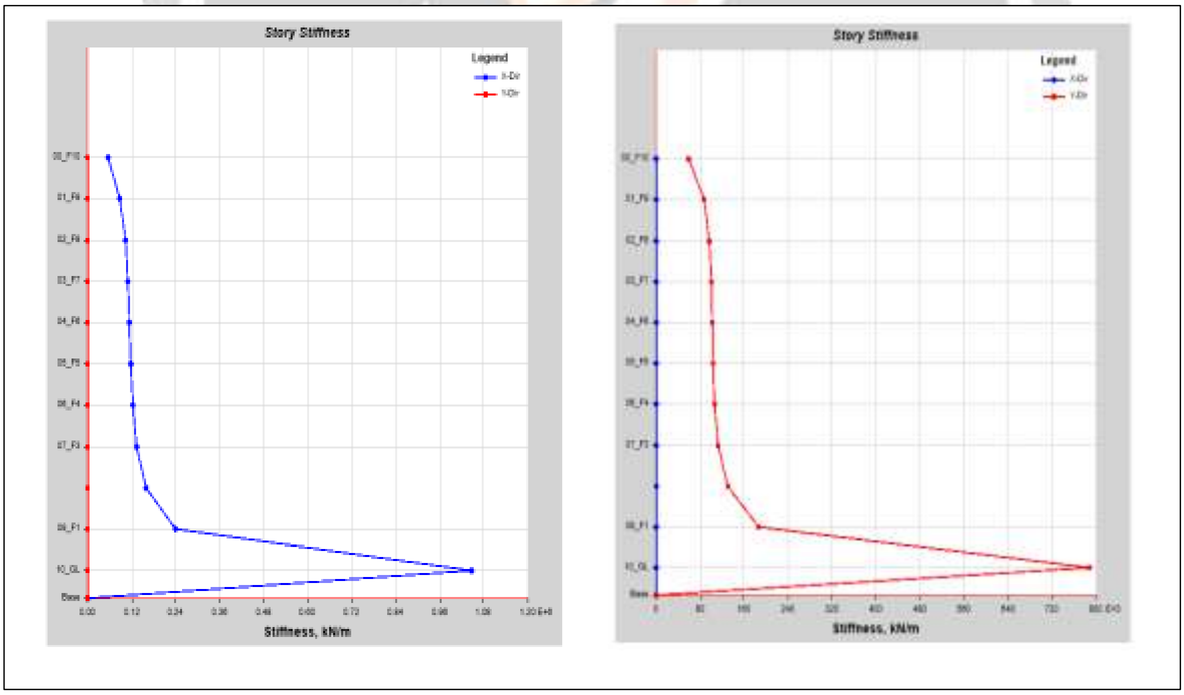

Fig.Graph 10. Story Stiffness at X and Y direction Due to load EQx and EQy

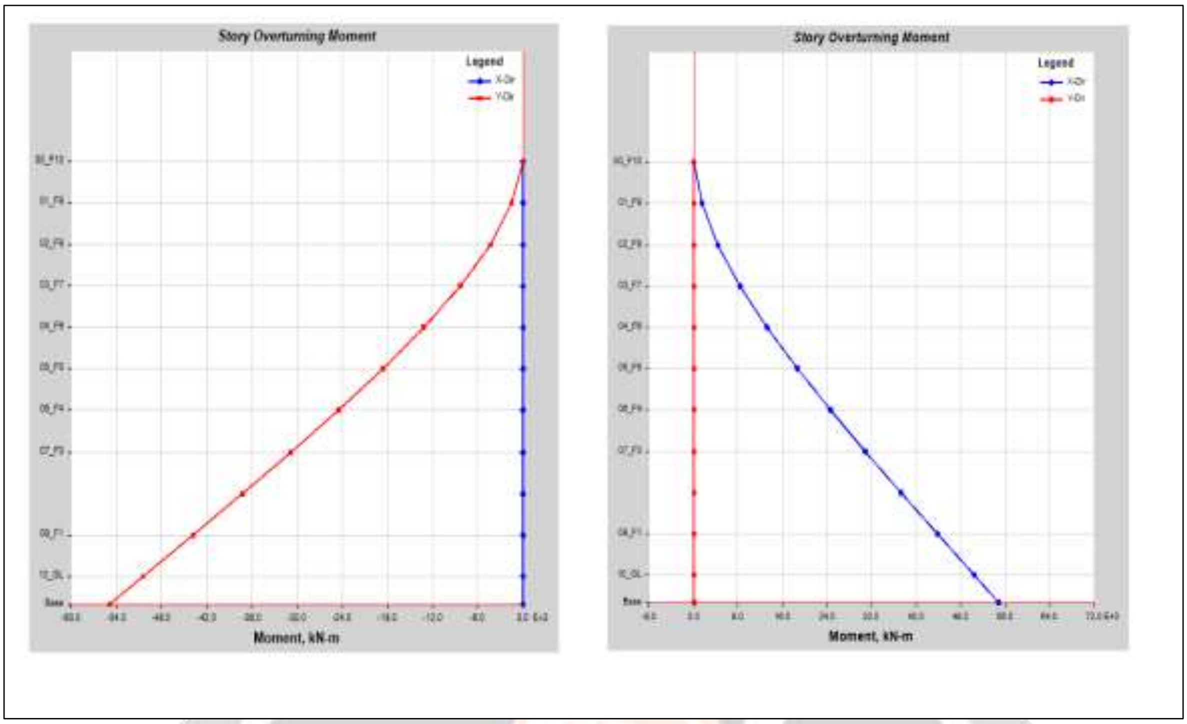

Fig.Graph 11. Story Moments at X and Y direction Due to load EQx and EQy

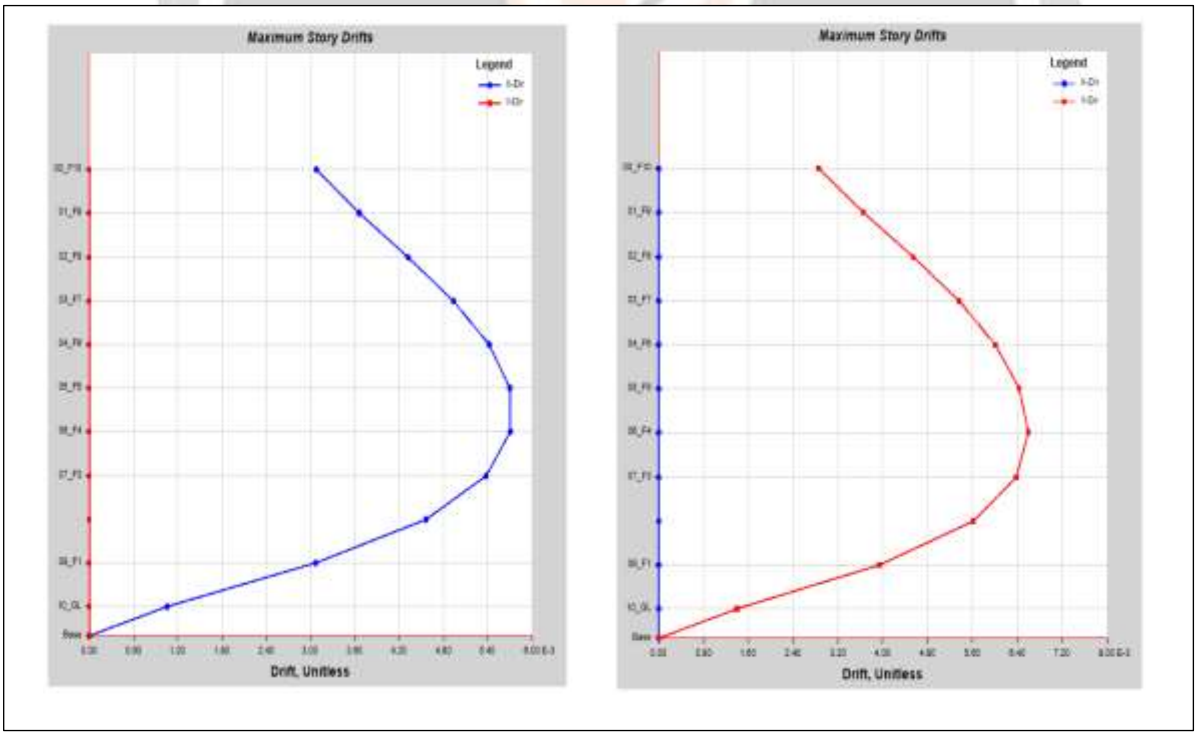

Fig.Graph 12. Story Drifts at X and Y direction Due to load EQx and EQy

V. CONCLUSION

1. The top floor has the most storey displacement, whereas the bottom storey has the least. The value of displacement grows as the height of the building rises.
2. To reduce excessive shear force and negative bending moment, a flat slab is given with a drop and column head.
3. The values of drift in both the X and Y directions are lower for Grid slab and irregular building systems than they are for Flat slab building systems. Grid slab systems will have less displacement than flat slab systems in terms of displacement.
4. ETABS is very essential tool to analyze the structure, and very fast and accurate results can be obtained.

VI. REFERENCES

[1] IS: 875-1987. 'Indian Standard Code of Practice for Design Loads (other than Earthquakes) for Buildings and Structures, (2nd revision).' Bureau of Indian Standard, New Delhi.

[2] K.N. Mate, Volume 4 Issue 6, June 2015 Study of Flat Slab, International journal of science and research (IJSR), pp.1106- 1110.

[4] IS1893-2002Indian standards code of practice for criteria of earthquake resistance design of structures.

[5] Navya shree K. Sahana. Use of flat slab in high seismic zone volume 3 issued on 08/august 2014.

[6] Professor Kavan M.R, Mohana HS Comparative study of flat slab ad conventional slab for earthquake using ETABS in all zones in INDIA volume2issue 03 june 2015

[7] M. Walker, a study on earthquakes-that gives earthquake and its effect.

[8] R. Clough, and J. Penzien, Dynamics of Structures, McGraw-Hill, New York.

[9] 1993 Structural Engineers Association of California, Recommended Lateral Force Requirements and Commentary, Structural Engineers Association of California, Sacramento, 1996.

[10] Earthquake Resistant Design of Structures (English) 1st Edition by Manish Shrikhande and Pankaj Agarwal.

[11] Bhavikatti S.S, "Advance R.C.C. Design", New Age International (p) Limited, Publishers, New Delhi, India.

[12] www.wikipedia.org