Analysis of G+15 High Rise Rise Buildings by Using Etabs for Various Frame Sections in Zone II and Zone III

PAWAN R. THAKARE
M tech (Structural Engineering), V. M. Institute of engineering &Technology Nagpur, Maharashtra

Abstract— ETABS stand for Extended Three-Dimensional Analysis of Building Systems. ETABS integrates every aspect of the engineering design process. In the present situations of construction industry, the buildings that are being constructed regaining significance, in general, those wise the best possible outcomes which are referred to members like beams and columns in multi storeys R.C structures. This software mainly used for structures like high-rise buildings, steel and concrete structures. The paper aims to analyze a high-rise building of 15 floors (G+15) by considering seismic, dead and live loads. The design criteria for high-rise buildings are strength, serviceability and stability. The version of the software used is ETABS 2016.In the present study, we are mainly determining the effects of lateral loads on moments, shear force, axial force, base shear, maximum displacement and tensile forces on structural system are subjected and also comparing the results of zone 2 and zone 3.

Indexed Terms-- ETABS; Seismic Analysis; High-rise buildings.

I. INTRODUCTION

Structural analysis mainly involves the act of discovering a structure when something happens. Such behavior may be due to the weight of objects such as people, furniture, wind and snow, or other forms of excitation such as earthquakes, ground shaking caused by nearby explosions, and the like. In essence, all of these loads are dynamic, including the weight of the structure, since at some point these loads do not exist. The distinction between dynamic and static analysis is based on whether the applied motion has sufficient acceleration compared to the natural frequency of the structure. If the load is applied slowly enough, the inertial force (Newton's second law of motion) can be neglected and the Analysis implified to static analysis.

Since earthquake forces are random in nature and unpredictable, the static and dynamic analysis of the structures have become the primary concern of civil engineers. The main parameters of the seismic analysis of structures are load carrying capacity, ductility, stiffness, damping and mass. The type of structural model selected is based on external action, the behavior of structure or structural materials, type of structural model selected.

High Rise Building-A building having height more then 15m as per National Building Code2005 of India is called High Rise Building. The materials used for the structural system of high-rise buildings are reinforced concrete and steel. Most North American style skyscrapers have a steel frame, while residential blocksare usually constructed of concrete. There is no clear definition of any difference between a tower block and a skyscraper, although a building with fifty or more stores is generally considered a skyscraper. High-rise structures pose particular design challenges for structural and geotechnical engineers, particularly if situated in a seismically active region or if the underlying soils have geotechnical risk factors such as high compressibility.

OBJECTIVE

- To study irregularities in structural analysis and design of G+15 storeys structure as per code (IS 1893:2002).
- To study the behavior of structure without masonry infill if seismic load is applied of displacements subjected to earthquake loading from zone 2 to zone 3
- To find out the bending moment and shear force

selecting any one section for various seismic zones
- Choosing of required materials as per exposure conditions and fire rating as per Indian Code and assigning of gravity loads (dead load, live load, super dead load) as per Indian standard provisions.
- Lateral stability checks for both the methods are carried out and compared.

1. Base shear
2. Storey drift
3. Storey displacement
4. Storey stiffness
5. Soft storey
6. Weak storey
7. Modes

Comparison of both zone 2 and zone 3.

II. LITERATURE REVIEW

Pardeshi Sameer and Prof. N. G. Gore (2016): This paper is concerned with the effects of various vertical irregularities on the seismic response of a structure. The objective of the project is to carry out Response spectrum analysis (RSA) of regular and irregular RC building frames and Time History Analysis (THA) of regular RC building frames and carry out the ductility-based design using IS 13920 corresponding to response spectrum analysis. Comparison of the results of analysis of irregular structures with regular structure is done.

Vinayak BKulkarni, Mahesh VT atikondab2016 IJARSE: Dynamic analysisis carried out using STAAD Pro software. The Loads on structure were considered as per IS standards. The dynamic analysis may be Response spectrum method or time history analysis method.Response spectrum method uses rules laid down in IS 1893 (part 1) 2002 and time history analysis can be carried out using previous Earthquake data. In this paper El Centro earthquake occurred in 1940, data is used. The results interms of lateral displacements with respect to each story are determined and compared story wise.

Dr.Okay.R.C.Reddy, Sandip A.Tupatet.,al.(2014):His research had stated that the wind hundreds and earthquake masses are estimated for a twelve storied RC framed constitution.Established on the results bought the following conclusions are made. The earthquake and wind hundreds rises with height of constitution. Wind loads are more valuable for tall structures than the earthquake loads.Constructions will have to be designed for loads recommendation independently for important forces of wind or earthquake.

III. STATEMENT OF PROJECT

Design data,

1. Building type. : Residential building
2. No.of storeys. : G+15
3. Building shape : Rectangular
4. Geometrical details
   a. Plan dimension : 25m×30m
   b. beam size : 300mm×500mm
   c. Column size : 500mm×600mm
   d. slab size : 150mm
5. Material details
   a. Concrete grade
      1. For Beam : M40
      2. For Column. : M45
      3. For Slab. : M40
   b. Steelgrade : HYSD reinforcement of Fe 415 & Fe 500
6. Type of construction. : R.C.C Framed structure
7. Load Pattern
   1. Dead Load
   2. Live Load : 3.5 KN/m^
   3. Live Roof. : 1.5 KN/m^
   4. Floor Finish. : 1.2 KN/m^
   5. Wall load. : 13.8 KN/m

STATIC EARTHQUAKE

Parameters	Zone 2	Zone 3
Seismic zone factor	0.01	0.16
Site type	2	2
Importantance factor	1.2	1.2

Response Reduction factor	3	3
Damping ratio	0.05	0.05

IV. METHODOLOGY

In the present study, analysis of G+15 multi-story building in all seismic zones for wind and earthquake forces is carried out. 3D model is prepared for G+15 multi-story building using ETABS.

METHODS OF ANALYSIS OF STRUCTURE

In the present study, analysis of G+15 building in most severs zone for wind and earthquake forces is carried out. 3D model is prepared for G+15 building is in ETABS. The seismic analysis should be carried out for the buildings that have lack of resistance to earthquake forces. Seismic analysis will consider dynamic effects hence the exact analysis sometimes become complex. However for simple regular structures equivalent linear static analysis is sufficient one. This type of analysis will be carried out for regular and low rise buildings and this method will give good results for this type of buildings. Dynamic analysis will be carried out for the building as specified by code IS 1893-2002 (part1). Dynamic analysis will be carried out either by Response Spectrum method or site specific Time history method.

Following methods are adopted to carry out the analysis procedure.

a. Equivalent Static Analysis
b. Response Spectrum Method
c. Time History Analysis.

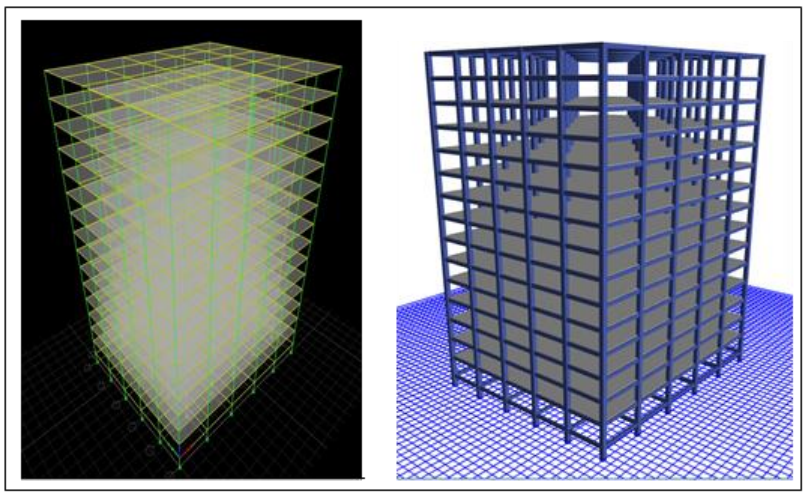
LOADS ACTING ON G+15 BUILIDING

Loading on tall buildings is different from low-rise buildings in many ways such as large accumulation of gravity loads on the floors from top to bottom, increased significance of wind loading and greater Importance of dynamic effects. Thus, high rise structures need correct assessment of loads for safe and economical design. Except dead loads, the assessment of loads cannot be done accurately. Live loads can be anticipated approximately from a combination of experience and the previous field observations. Wind and earthquake loads are random in nature and it is difficult to predict them. They are estimated based on a probabilistic approach. The following discussion describes some of the most common kinds of loads on high raised structures.

a. Dead loads
b. Live loads (or) Imposed Loads
c. Gravity loads
d. Wind loads
e. Earthquake loads.

V. RESULTS AND ANALYSIS

3D MODEL OF STRUCTURE AFTER ANALYSIS



6.1 GRAPHICAL RESULTS OF MULTI STORY G+15 BUILDING FOR ZONE-II

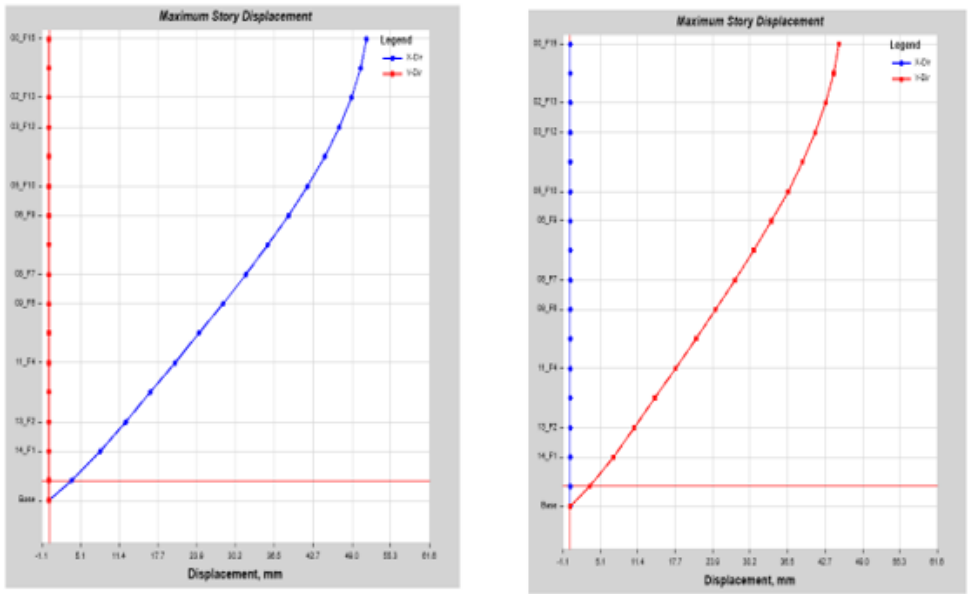


Fig.6.1(a) Maximum story Displacement at X and Y direction Due to load EQx and EQy

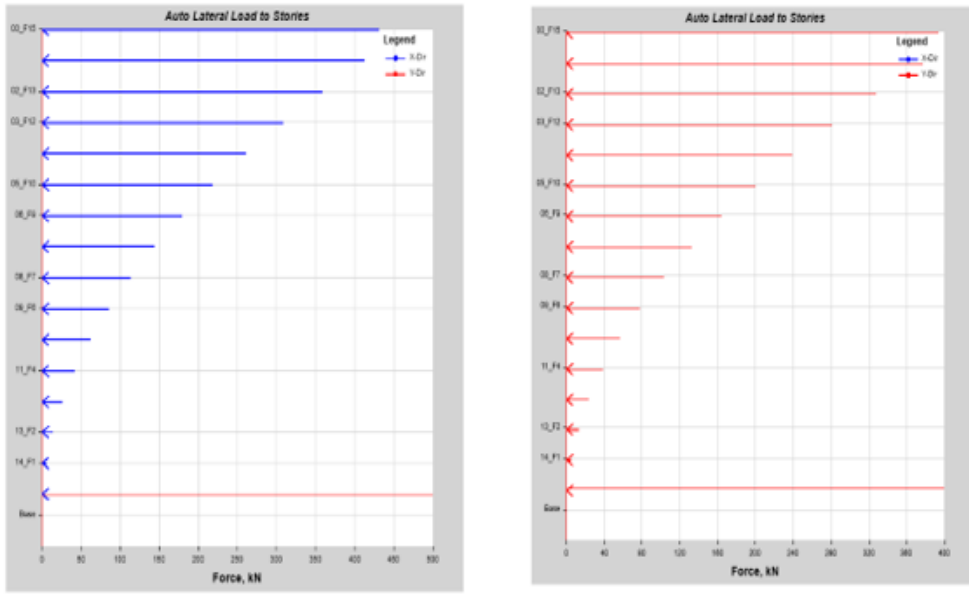


Fig.6.1(b) Lateral Loads at X and Y direction Due to load EQx and EQy

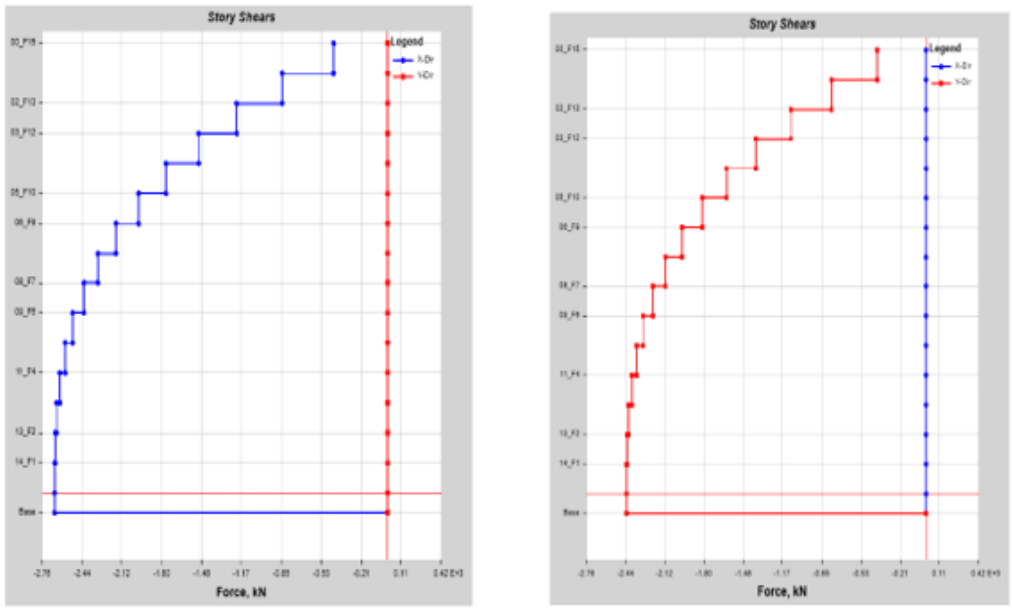


Fig.6.1(c) Story Shear at X and Y direction Due to load EQx and EQy

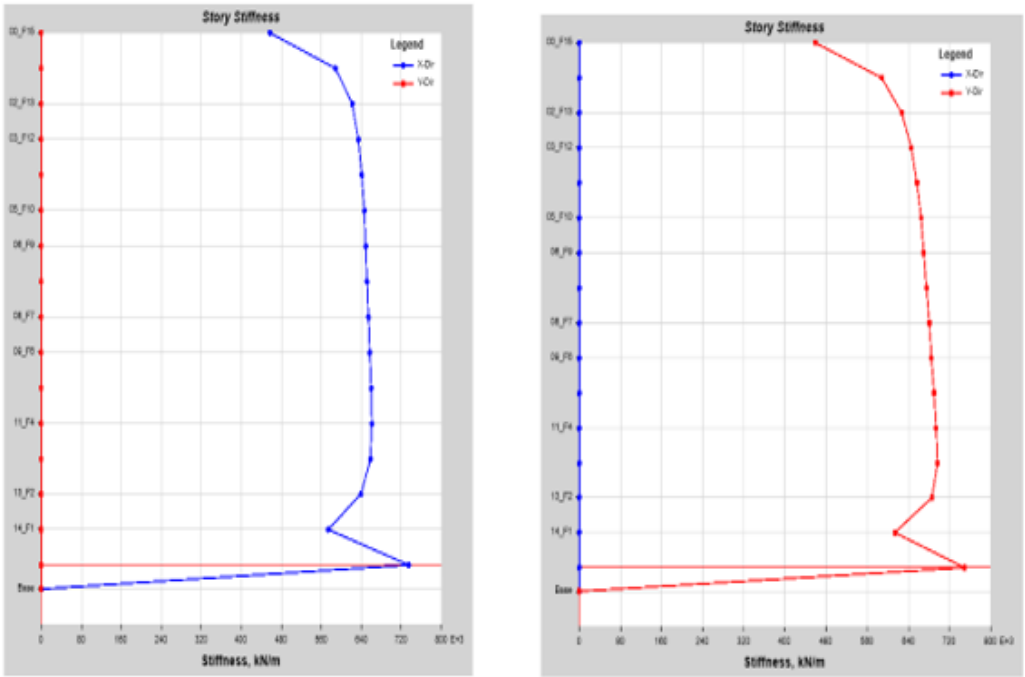


Fig.6.1(d) Story Stiffness at X and Y direction Due to load EQx and EQy

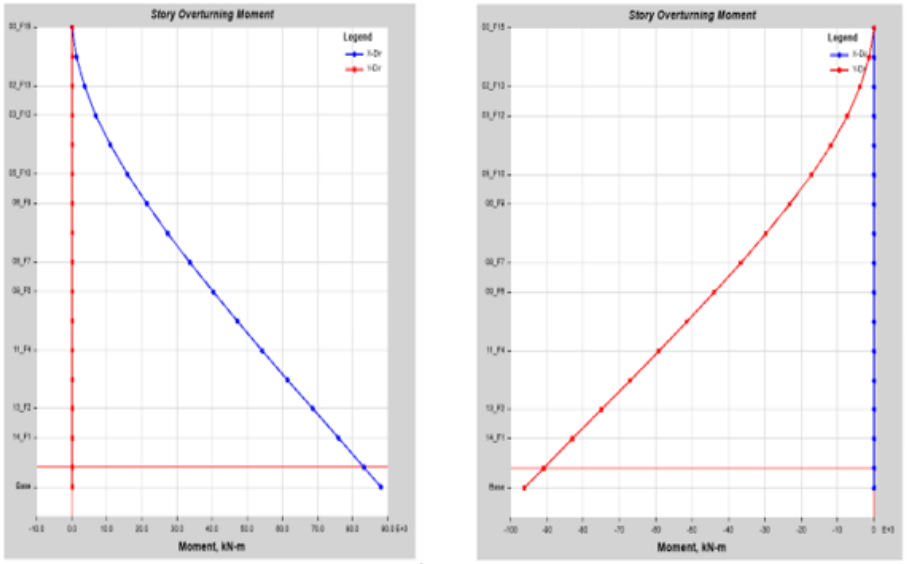


Fig 6.1(e) Story Moments at X and Y direction Due to load EQx and EQy

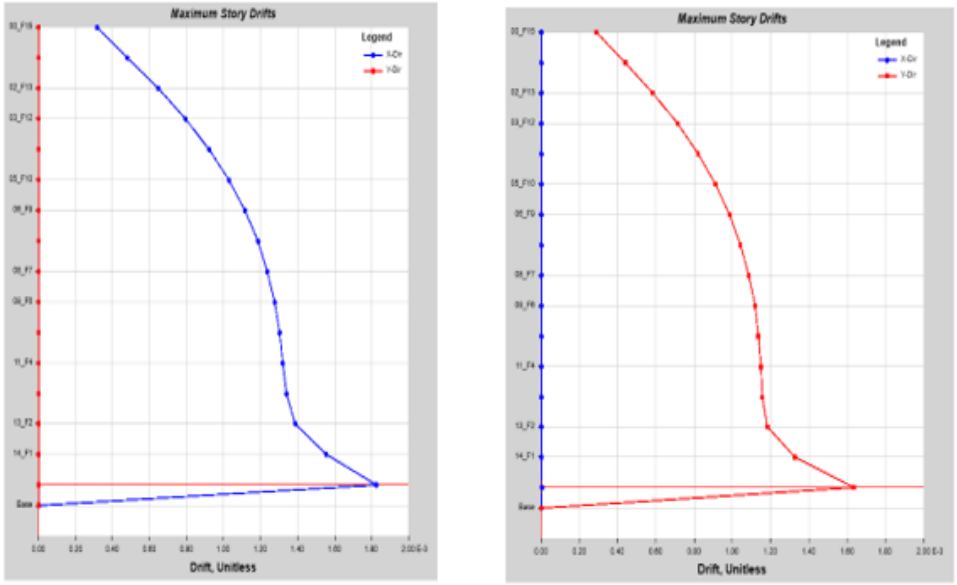


Fig.6.1(f) Story Drifts at X and Y direction Due to load EQx and EQy

6.2 GRAPHICAL RESULTS OF MULTI STORY G+15 BUILDING FOR

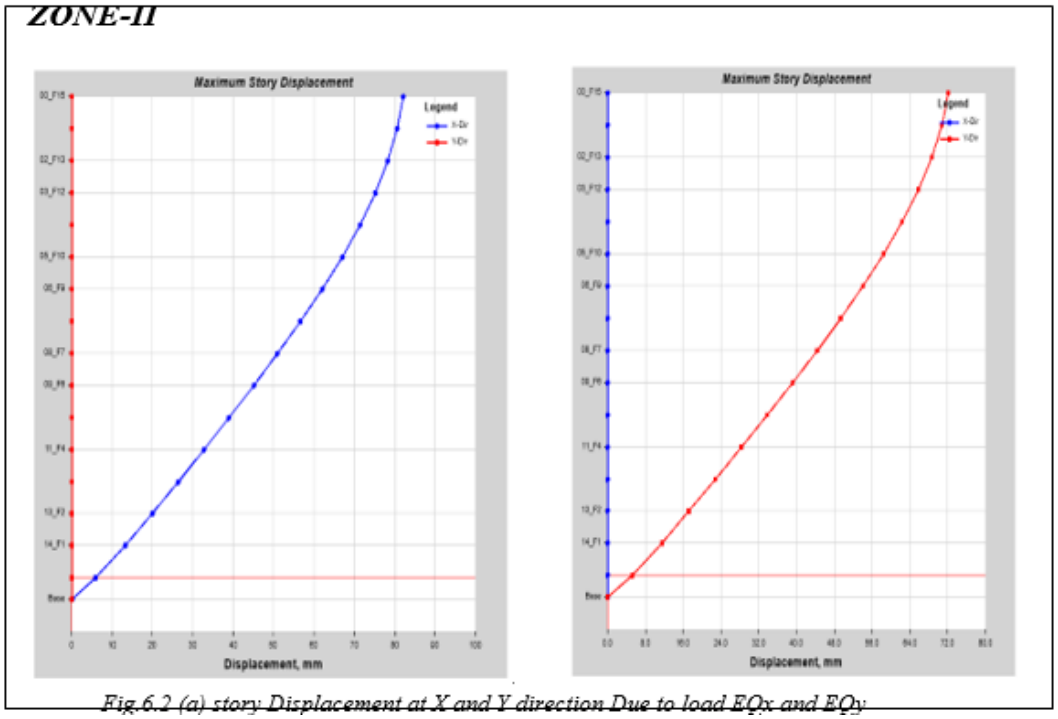


Fig.6.2 (a) story Displacement at X and Y direction Due to load EQx and EQy

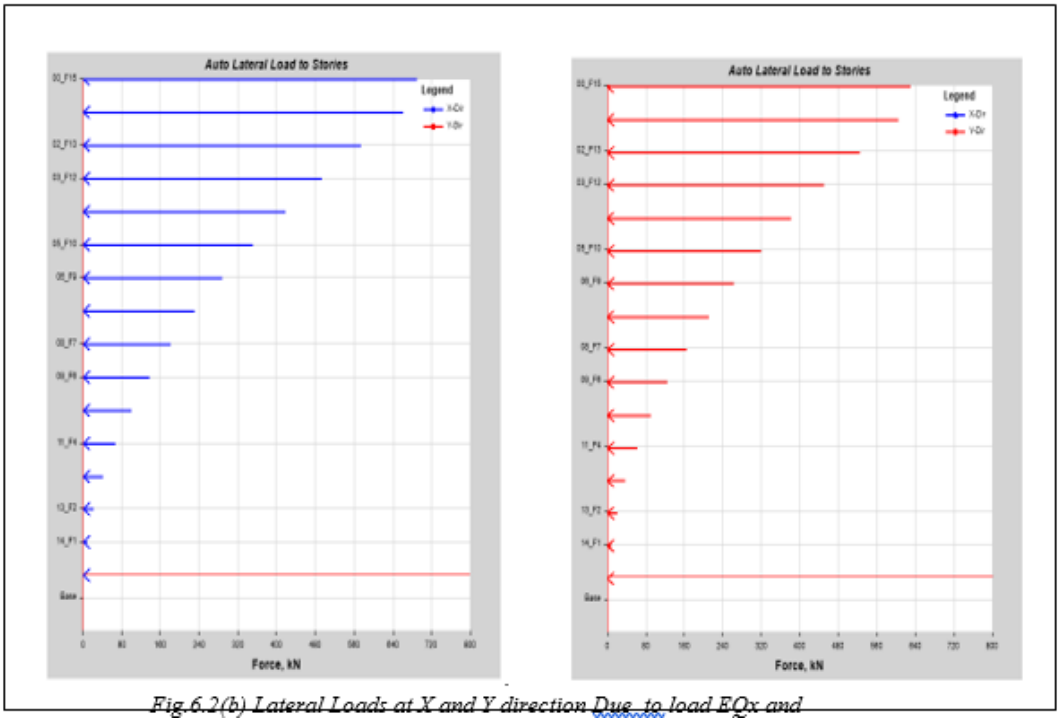
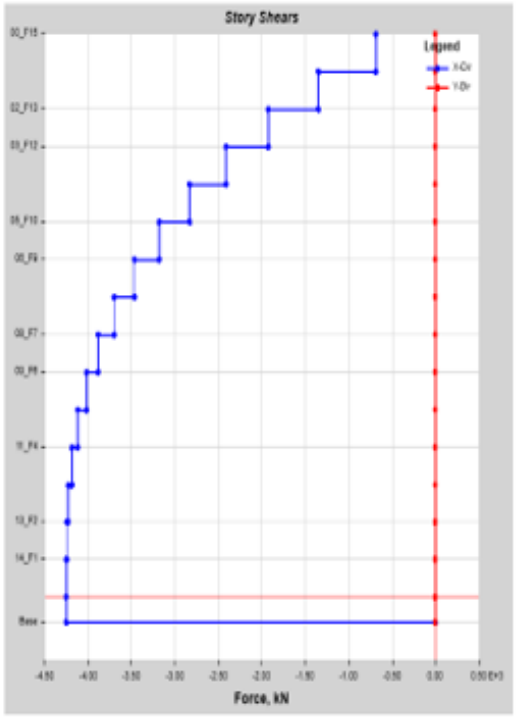


Fig.6.2(b) Lateral Loads at X and Y direction Due to load EQx and



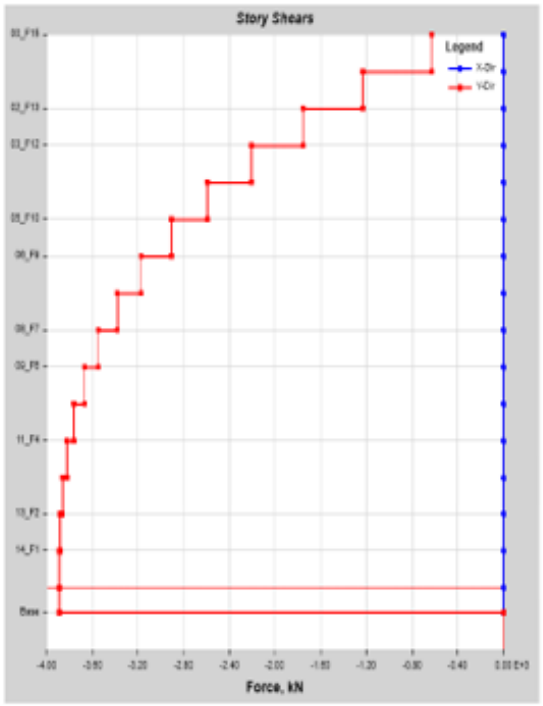
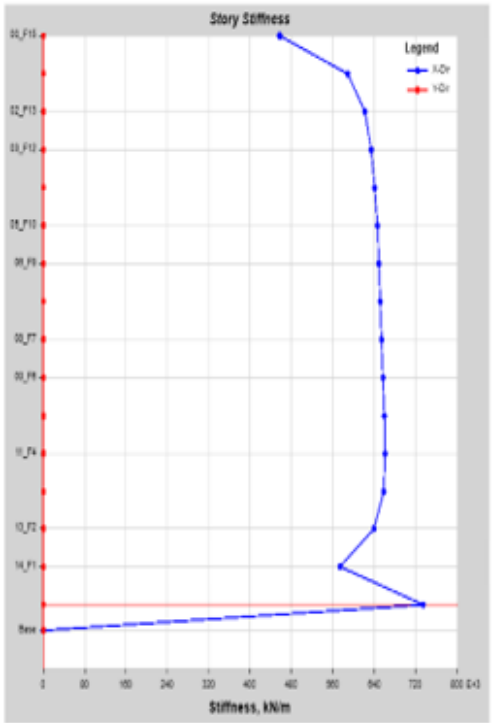


Fig.6.2(C) Story Shear at X and Y direction Due to load EQx and EQy



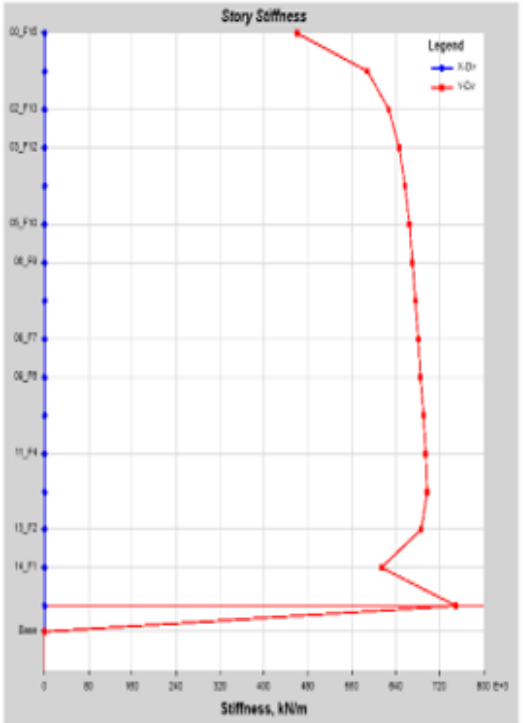


Fig.6.2(d) Story Stiffness at X and Y direction Due to load EQx and EQy

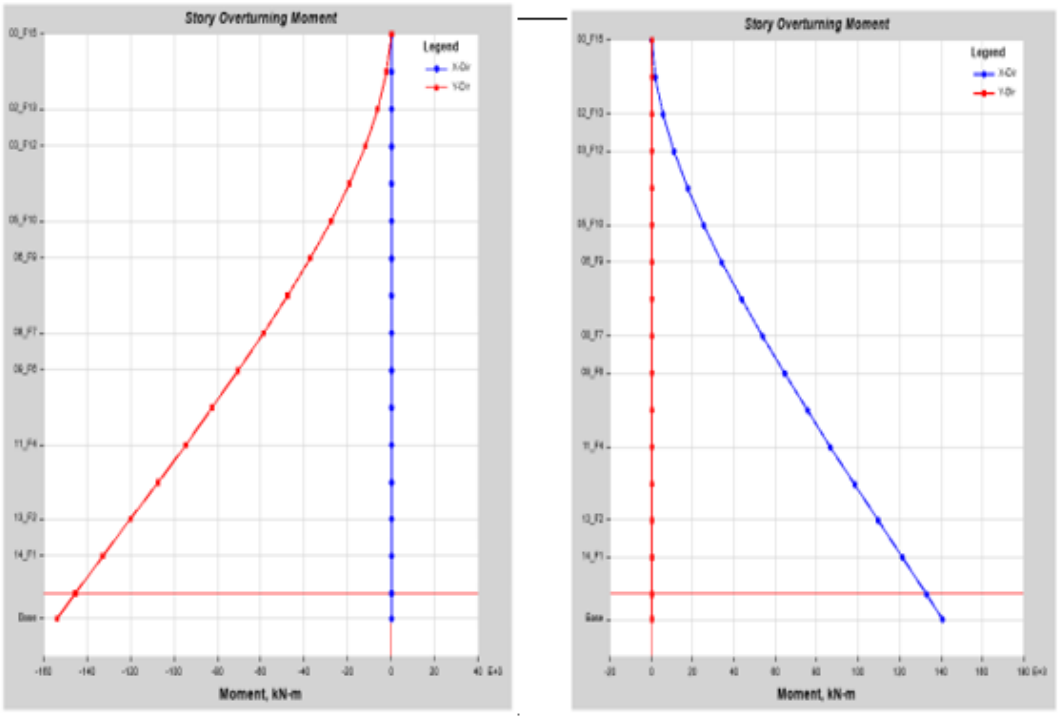


Fig.6.2(e) Story Moments at X and Y direction Due to load EQx and EQy

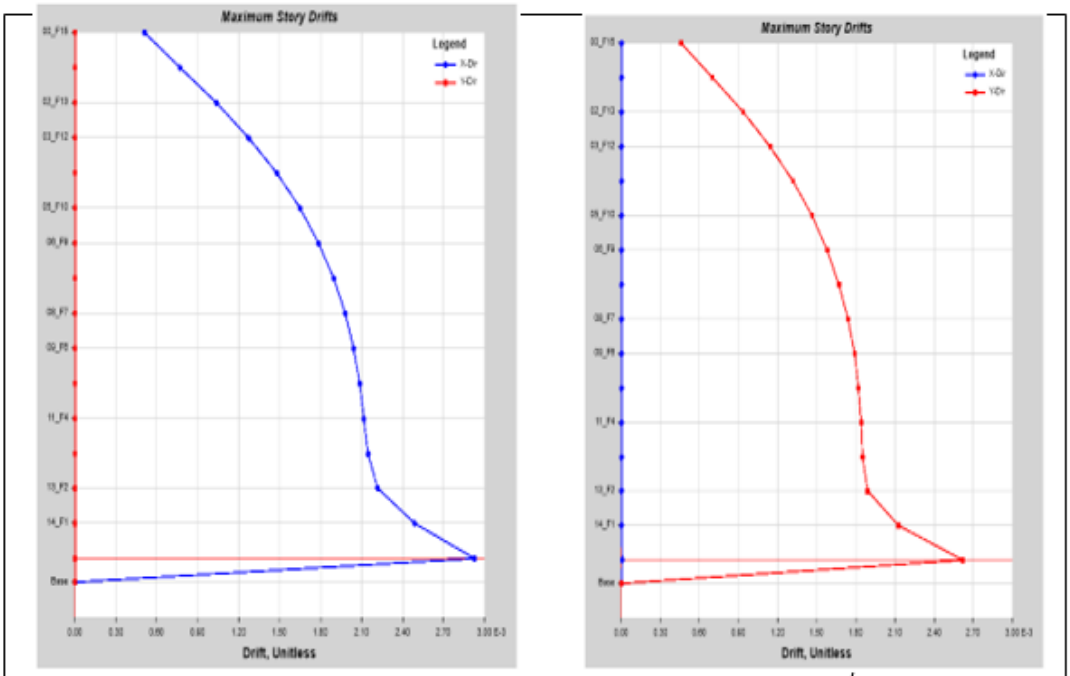


Fig.6.2. (f) Story Drifts at X and Y direction Due to load EQx and EQ

CONCLUSION

- A high-rise building of 15 floors subjected to seismic, wind and live loads were analyzed using ETABS 2016 software.
- Behavior of the high-rise building was shown clearly using the graphs and lateral displacements.
- The zone 3 has higher value of drift as we compared the drift values in zone 2.
- The story shear is maximum for the moments as we compared with the forces in all stories for zone 2 and zone 3. In zone 3 has higher value of shear as we compared with zone2.
- Better accuracy of the analysis can be obtained by using this software.

REFERENCES

[1] IS 1893 (part1): (2002), "Criteria for Earthquake Resistant Design of Structures Part General Provisions and Buildings" ,Bureau of Indian Standard.

[2] CSI Computers and Structures INC." Introductory Tutorial for ETABS:Linear and Non linear Static and Dynamic Analysis and Design of Three-Dimensional Structures" 2011

[3] B.C.Punmia, A.K.Jain, 2006 ,R.C.C Designs",Laxmi Publications New Delhi.

[4] IS-456 :2000 plain and reinforced concrete code of practice

[5] Ali Kadhim Sallal,"Design and analysis ten storied building using ETABS software 2016"

[6] Gauri G. Kakpure and Ashok R. Mundhada " Comparative Study of Static and Dynamic Seismic Analysis of Multistoried RCC Building by ETAB" IJERMT 2016, :2278-9359 (Volume-5, Issue-12)

[7] Taranath B.S.,"Structural Analysis and Design of Tall Buildings"McGraw-Hill Book Company,1988.

[8] CSI ETABS 17..0.1

[9] //www.wikipedia.org/