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A COMPARATIVE STUDY ON DYNAMIC ANALYSIS OF MULTI-STORIED BUILDING (G+24) WITH VERTICAL IRREGULARITIES

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Abstract - *The effective procedure for evaluating the seismic performance of building is called dynamic analysis. There will be definitely formation of many weak points in irregular plan. Therefore these type of structure need to be analyzed under dynamic analysis. This project contains multi-story building (G+24) having vertical plan irregularities. The changes occurs in plan vertically after 6th, 12th & 18th floor. By using STAAD pro as well as ETABS software models are created separately. The response spectrum method of analysis are used.*

***Key Words*: Response spectrum method, Etabs, Staad pro, Irregular Maximum displacement, Storey shear, Frequency, IS-1893(part1):2016.**

1.INTRODUCTION

The effective procedure for evaluating the seismic performance of building is called dynamic analysis. Due to lack of land, construction of high rise building is basic need in this sector. In actual practice building shows one of the irregularities i.e. diaphragm, stiffness etc. Damages generally occurs at weak points of the building during Earthquake. Due to irregularity in plan there are definitely formation of many weak points. Therefore these type of structure need to be analyzed under earthquake loading considering seismic design theories so that they can sustain moderate to strong earthquake easily. The manual design of multi-storey building is time consuming and also develop human errors. Hence use of computer based softwares are mandatory which gives more correct results and saves the time.

There are many methods used for dynamic analysis i.e. Response spectrum method and Elastic Time history method, Equivalent static lateral force method. The Harm control is one of dominant design considerations which is increasing its impact. The harm control can be fulfilled only by initiating dynamic analysis in the design Softwares like ETABS, STAAD PRO and SAP are used for Seismic analysis. Using various load combination to verify various codes such as IS 456-2000, IS 1893-2016 modeling are done.

The response spectrum method shows SDOF system to a particular input motion at different natural periods. This method provides frequency effect and gives a single suitable horizontal force to structure.

2. OBJECTIVE

For the project, the following objectives have been set.

a. To carry out modelling of multi-storey building of (G+24) with vertical irregularities by using Staad pro and Etabs software
b. To analyses building using Response Spectrum Method by both the software.
c. To compare the dynamic behavior of structures on both softwares and discuss the results such as Maximum Displacement, Peak storey shear, Frequencies.

3. MODELLING AND ANALYSIS

A. Modelling

A (G+24) storied building with vertical irregularities located in zone III of India as per IS-1893(Part1):2016 were taken for the investigation. The Modelling and analysis of the building process is different for both the software. In ETABS we can directly assign floor load of all floors or single floor. But In case STAAD pro we have to decide Y-Range of each floor. Complete quadratic combination method (CQC) is used for determining the maximum seismic response. In both softwares response spectrum method is used to find values of maximum storey displacement, Peak storey Shear, Frequencies.

Table -1: Building Description

Particulars	Reinforced concrete Building
Occupancy	Residential building
Number of stories	(G+24)
Total height of building	73 M
Ground floor height	2.9 M
Intermediate floor height	2.9 M
Nature of soil	Medium soil
Seismic zone	III (Table 3,IS 1893 part1:2016)

Table -2: Member Dimensions

Column Size	380 x 750 MM
Beam size	230 x 530 MM
Slab Thickness	150 MM
External wall thickness	200 MM
Internal wall thickness	150 MM

Table -3: Loading Considered

Live load on floor	2KN/m^2 (IS 875 part2:1987)
Sunk load	7.17 KN/m^2
Floor finish Load	1 KN/m^2 (IS875 part2:1987)
Staircase Load	20 KN/m^2
Parking Load	5 KN/m^2
Lift Machine Room Load	10 KN/m^2
External Wall load	5.075 KN/m
Internal wall Load	3.045 KN/m
Importance Factor	1.2 (IS 1893 part1:2016)
Response Reduction Factor	5 (IS-1893 part1:2016)
Supports	Fixed

Table -4: Material Used

Grade of concrete	M25
Grade of steel	Fe-500
Density of concrete	25KN/m^3(IS-875 part1:1987
Density of AAC Block	7 KN/m^3

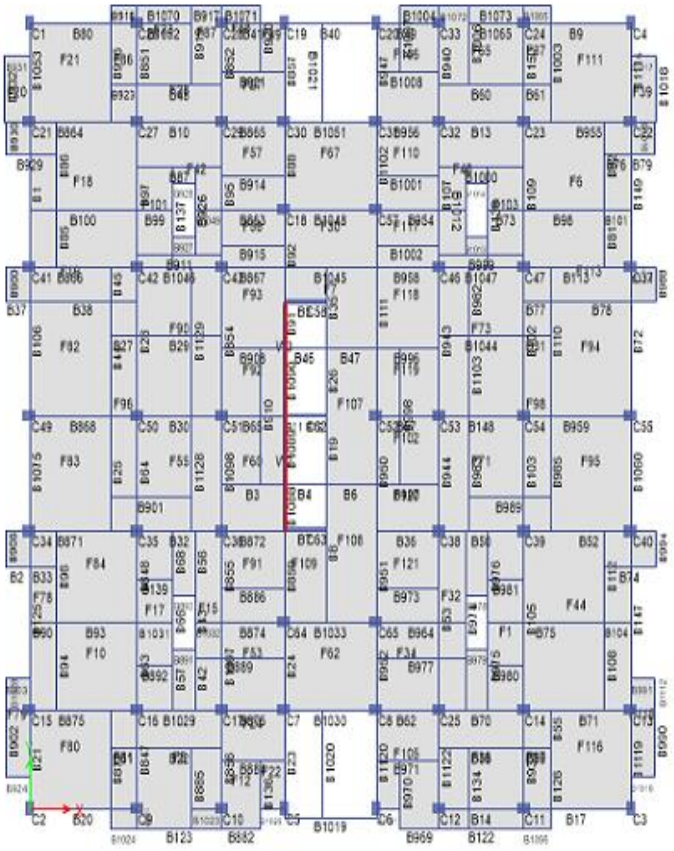

Fig -1: Plan of model using ETABS

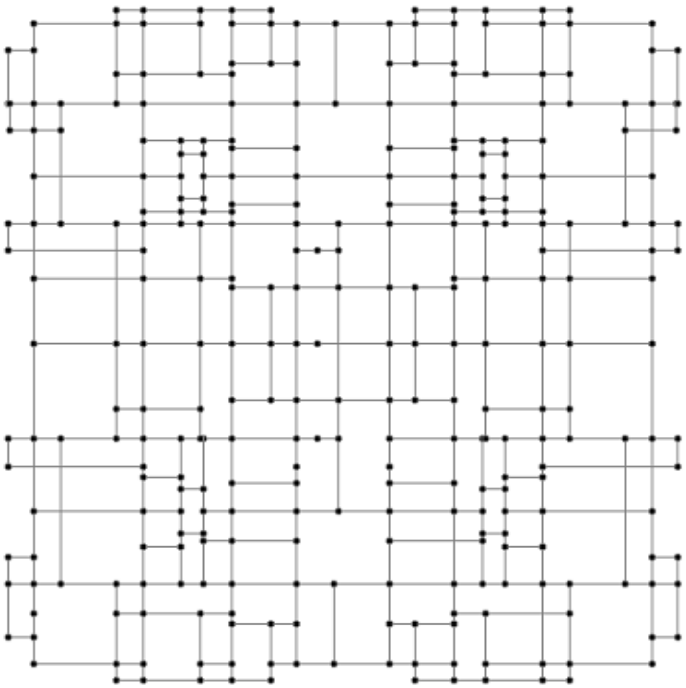

Fig -2: Plan of model using STAAD PRO

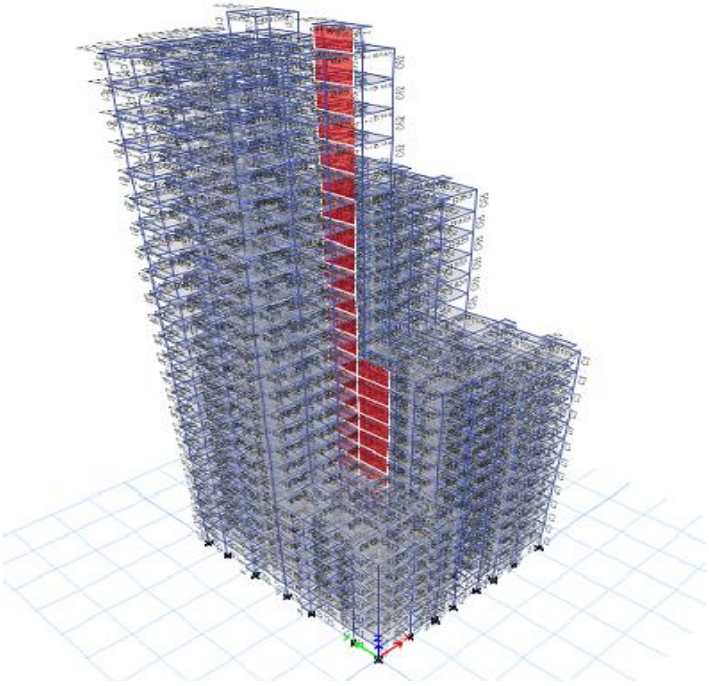

Fig -3:3D view of model using ETABS

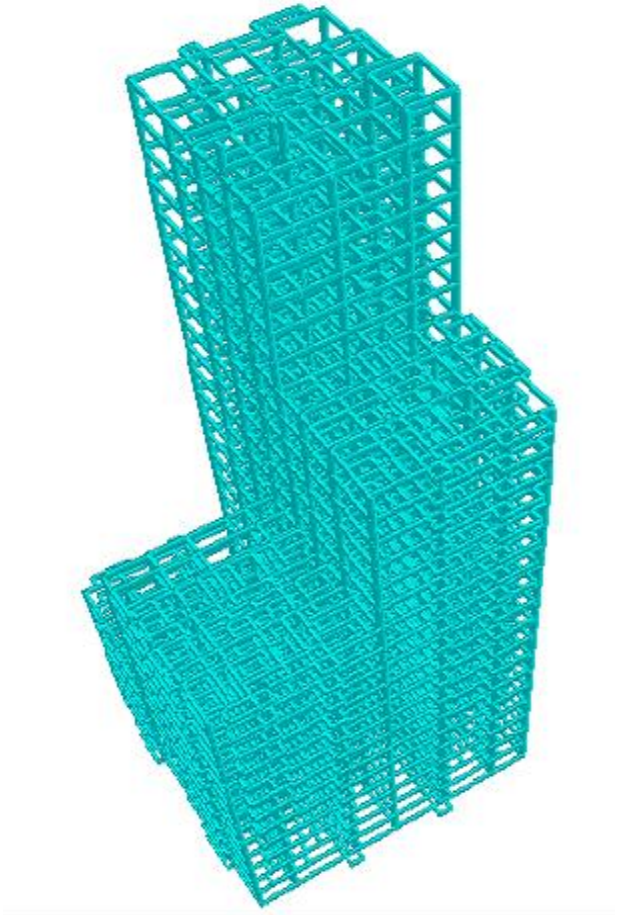

Fig -4: 3D View of model using STAAD PRO

4. RESULTS

From response spectrum analysis storey displacement, peak storey shear, frequencies for structural models are obtained from ETABS and STAAD PRO softwares also the results are graphically presented below.

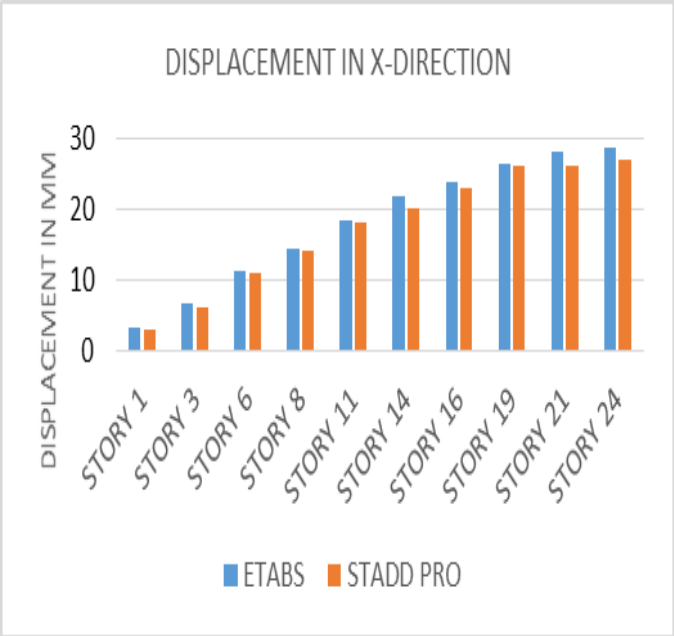

Chart -1: Displacement in X-direction by both softwares

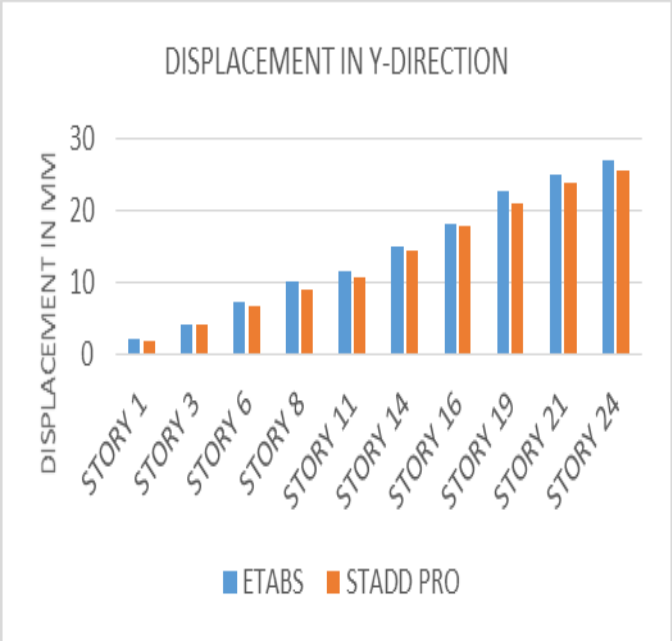

Chart -2: Displacement in Y-direction by both softwares

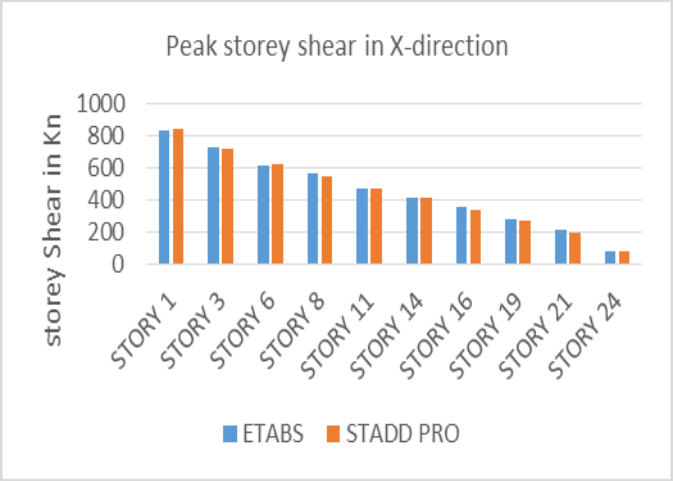

Chart -3: Peak storey shear in X-direction by both softwares

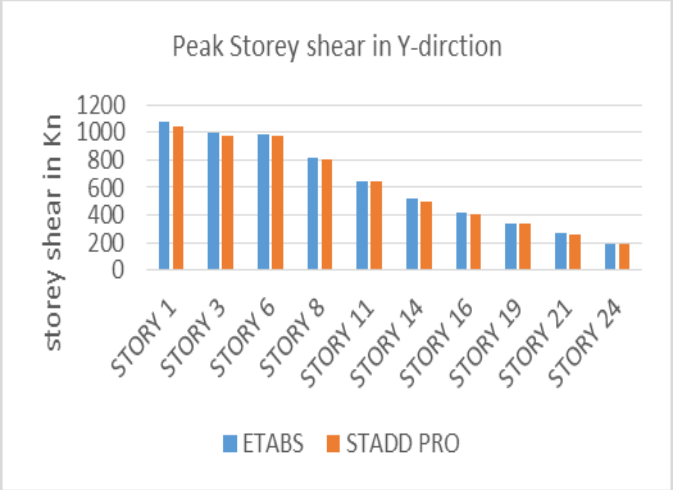

Chart -4: Peak storey shear in Y-direction by both softwares

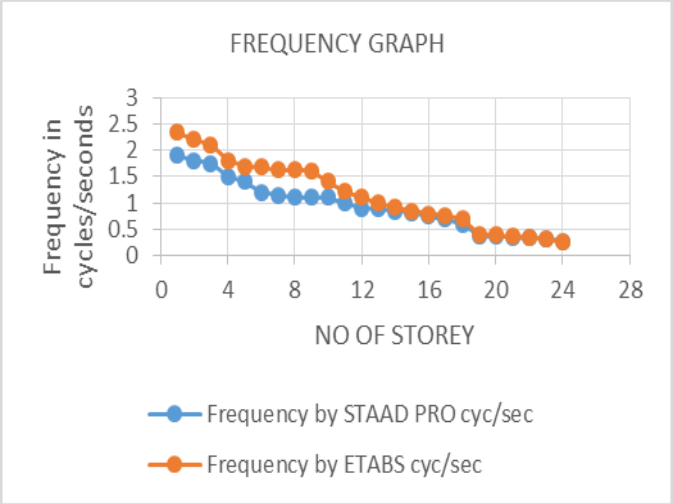

Chart -5: Frequency by both softwares

5. CONCLUSIONS

1. The results show maximum storey displacement & storey shear approximately same values for both the softwares.
2. There is slight variation in frequency by both the softwares but it is negligible.
3. Up to 18th floor, center of mass and center of rigidity shows approximately same value. So building shows balanced resistance.
4. Above 19th floor, values of center of mass and center rigidity are different. So structure shows rotational displacement.
5. For analysis of multi-storey building ETABS software is more user friendly, time saving.
6. In ETABS software, it is easy to assign various loads and it is easy to apply response spectrum analysis.

REFERENCES

[1] Sayeed ur Rahaman, Dr.Sabih Ahmad "Comparative Study of Static and Dynamic Analysis of Irregular Reinforced Concrete Building due to Earthquake". JETIR (APRIL2019) Pages. 350-358

[2] Prof . Neeraj Singh Bais, Sayali Jilhewar "Comparison of Analysis of Multi-Storied Building by ETABS & STAAD – Pro: Effect of Number of Stories" –IRJET (Aug-2021) Pages.692-695

[3] Kolagani.Navya Deepthi, Kolla.Naga Sreenivasa Rao "Comparison of Design Results of Rcc (G + 8 Storey) Building Using STAADPro And ETABS Software."– IJSDR(Jun 2018) Pages.278-284

[4] D.Ramya, A.V.S.Sai Kumar "Comparative Study on Design And Analysis of Multistoryed Building (G+10) By STAAD.Pro And ETABS Software's" –IJESRT (Oct 2015) Pages.125-130

[5] B.Rajesh, Mr.Sadat Ali Khan, Mr.Mani Kandan, Dr.S.Suresh Babu "Comparison of Both Linear Static And Dynamic Analysis of Multistoryed Building with Plan Irregularities" – IJSEAS (Oct 2015) Pages.512-518

[6] Mohit Sharma, Dr.Savita Maru "Dynamic Analysis of Multistoried Regular Building" –IOSR-JMCE (Jan 2014) Pages.37-42

[7] NI NI WIN, KYAW LIN HTAT[2] "Comparative Study of Static and Dynamic Analysis of Irregular Reinforced Concrete Building due to Earthquake." – IJSETR(May-2014)Pages.1205-1209

[8] Bahador Bagheri, Ehsan Salimi Firoozabad, Mohammadreza Yahyaei "Comparative Study of the Static And Dynamic Analysis of Multi- Storey Irregular Building" –IJCEE (2012) Pages.1045-1049