International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June 2019 www.irjet.net p-ISSN: 2395-0072

DESIGN OF EARTHQUAKE RESISTANT STRUCTURE OF MULTI-STORY RCC BUILDING

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Abstract: *Reinforced concrete frames are the most commonly method of construction used in India. In this study the aim is to analyze the response of a high-rise structure to lateral loads using static and dynamic seismic loads and static wind loads. This analysis procedure is based on IS codes for design analysis of Structures. I have analyzing the G+21 earthquake resistant multi-story reinforcement cement concrete building. The building are analyze in earthquake zone III (LUCKNOW) in India. This zone is comes under moderate risk earthquake zone of India. This building is design by ETABS software. These projects are classifying the seismic analysis with lateral forces by the effect of earthquake. Design & construction of an earthquake resistant structure have more important to all in the world. Project is to learn relevant Indian standard codes are used for design of various building elements such as beams, columns, slabs, foundation, and stair. Analysis of all buildings story components with seismic action in the limit of Indian standard code provision.*

Key words**: **ETABS, earthquake zone, seismic loads and wind loads etc.

Introduction: Design & analysis of G+21 story earthquake resistant multi-story RCC building with the help of ETABS software. Also can be analysis the foundation of the structure with the help of STAAD-PRO software. High-rise building having height more than 15m as per national building code of India is called high rise building. The materials used for the structural system of high-rise buildings are reinforced concrete and steel. Most of the North American region style skyscrapers have a steel frames, while residential blocks are 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. The tall building stiffness elements are required to control the lateral drift from the serviceability consideration. This design have earthquake resistant structure are providing the dynamic and structural response. 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. Masonry walls provide support for all gravity loads as well as resistance to lateral loads. The walls and partition walls supply in plane lateral stiffness and stability to resist winds and earthquake loadings. This system lacks in providing redundancy for the vertical and lateral support. That is if wall fails. In this used the IS: 4326-1993. In which members and joint are capable of resisting vertical and lateral load primarily by flexural. The beam column joint is the most crucial component.

Example — Seismic Analysis & Design of a G+21 Multi-Story Building

Problem Statement: A G+21 multi-story RC building for a commercial complex has plan dimensions as shown in Figure 1. The building is located in seismic zone III on a site with medium soil. Design the building for seismic loads as per IS: 1893 (Part 1): 2002.

General:

1. This structure is mainly consist of different rooms, stair and lift portion with size in proper arrangement given the figure 1. The analysis and design will be occurs with the help of ETABS software.

2. The building will be used for commercial works and exhibitions purpose. It is consist of art gallery & show room etc. So that there are no walls inside the building. Only external walls 300 mm thick with 12 mm plaster on both sides are considered. For simplicity in analysis purpose. There are not used balconies & offset wall are used in the building.

3. At the level of earth can exists only columns at the foundation, not provides the beams and slabs. But in ground floor beam is occur at the level of slabs.

4. Continually one by one story can occur also given the columns and per story beams to arrange the building frames.

5. The main beams rest centrally on columns to avoid local eccentricity, for all structural elements are design M35 grade of concrete used. However at worst condition higher M40 grade of concrete is used for central columns up to plinth level, ground floor to the first floor.

6. The floor diaphragms are assumed to be rigid.

7. The structure layout should be simple and regular avoiding offset of beams to column, or offsets of column from floor to floor. Changes in stiffness should be gradual from floor to floor.

8. The amount of tensile reinforcement in beam should be restricted and more compression reinforcement should be provided. The letter should be enclosed by stirrups to prevent it from buckling.

9. Beams & column should be equal width.

10. The structure should be designed on strong column weak beam concept.

11. Load should be uniformly distributed.

12. All dimension are in meter

Data of the example

The design data shall be as fallow:

Location : LUCKNOW (ZONE III)

Zone factor : 0.16

Importance factor : 1.0

Response factor : 3.0

Damping ratio : 0.05

Live load : 4.0 KN/M at typical floor
: 1.5 KN/M on terrace

Earthquake load : As per IS: 1893 (Part 1) – 2002 .
Floor finish : 1.0 KN/M

Depth of foundation below ground : 2.5 m

Type of soil : Type II, Medium as per IS: 1893

Allowable bearing pressure : 200 KN/M^2
Ground beams : To be provided at 100 mm below G.L

Plinth level : 0.6 m

Walls : 300 mm thick brick walls only at periphery

Beams size : 400 X 600 in mm

Column size : 400 X 900 in mm

Slab : 150 in mm

Shear walls : 300 in mm

Grade of concrete : M 35

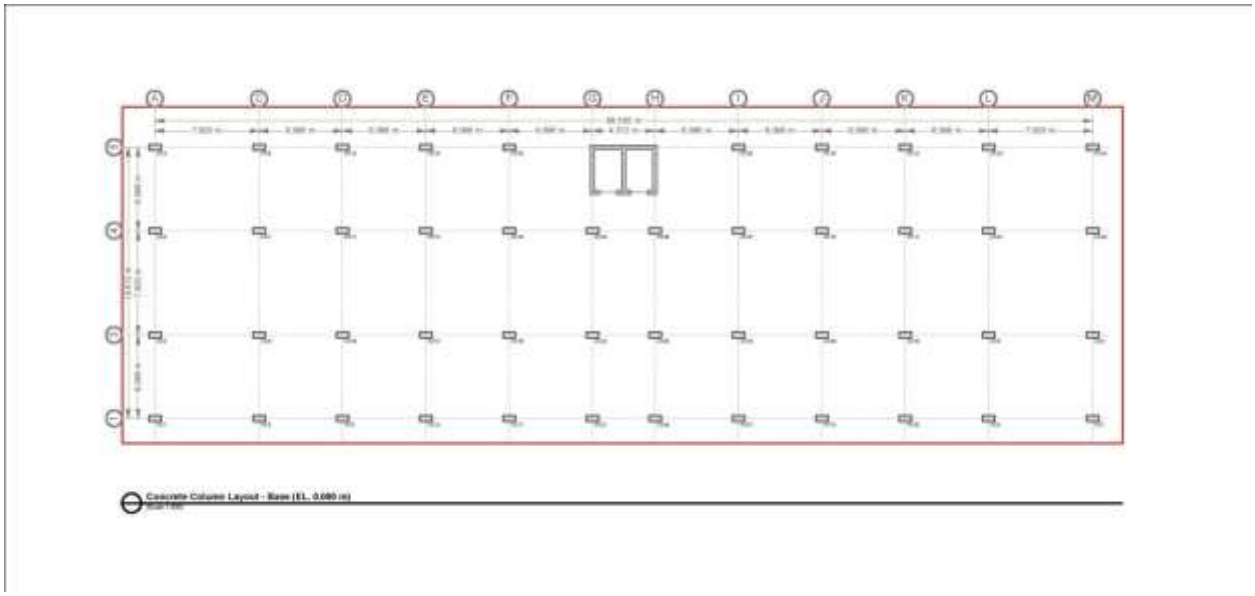
Grade of steel : HYSD 500

Poisson ratio : 0.2

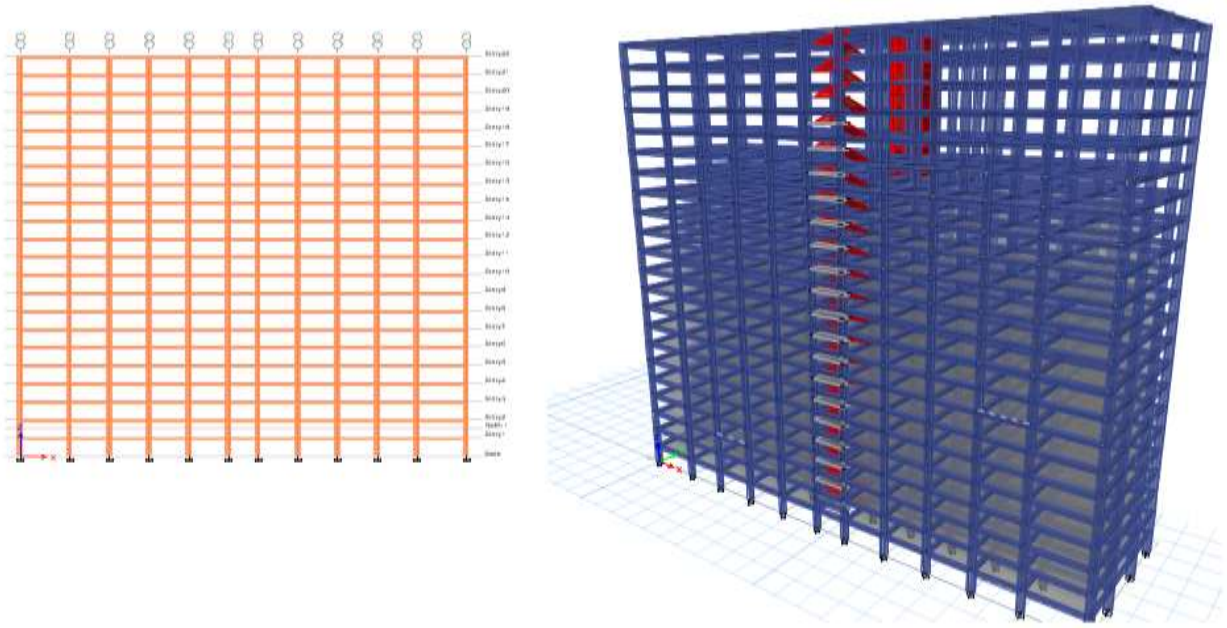
1.1 Geometry of the building

G+21 multi-story RCC buildings have designed by computer aided application using E-tabs software for analysis the frame, slab and walls. The G+21 multi-story RCC building draw the plan.

Plan view:



Elevation view:



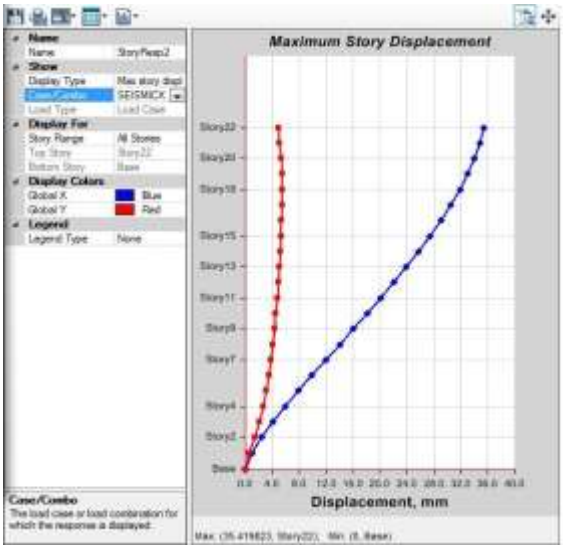
Typical layout of building

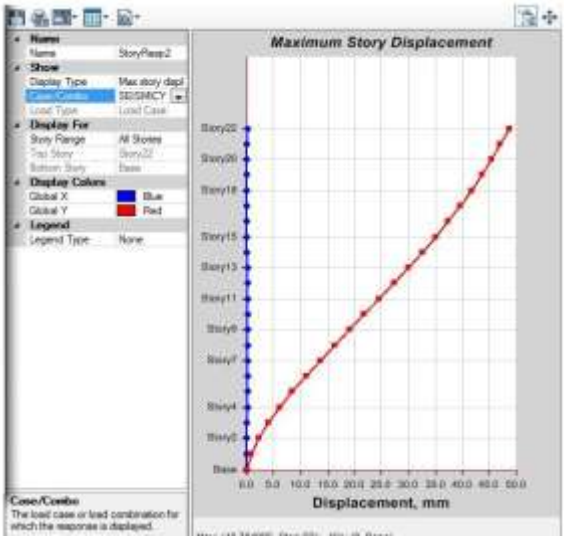
1.3 Analysis

Building analysis should be work in the Indian code provision as per IS: 1893-2002. This is design the seismic zone map specify seismic force. G+21 high rise buildings are different types of analysis considered

1.3.1 Equivalent analysis

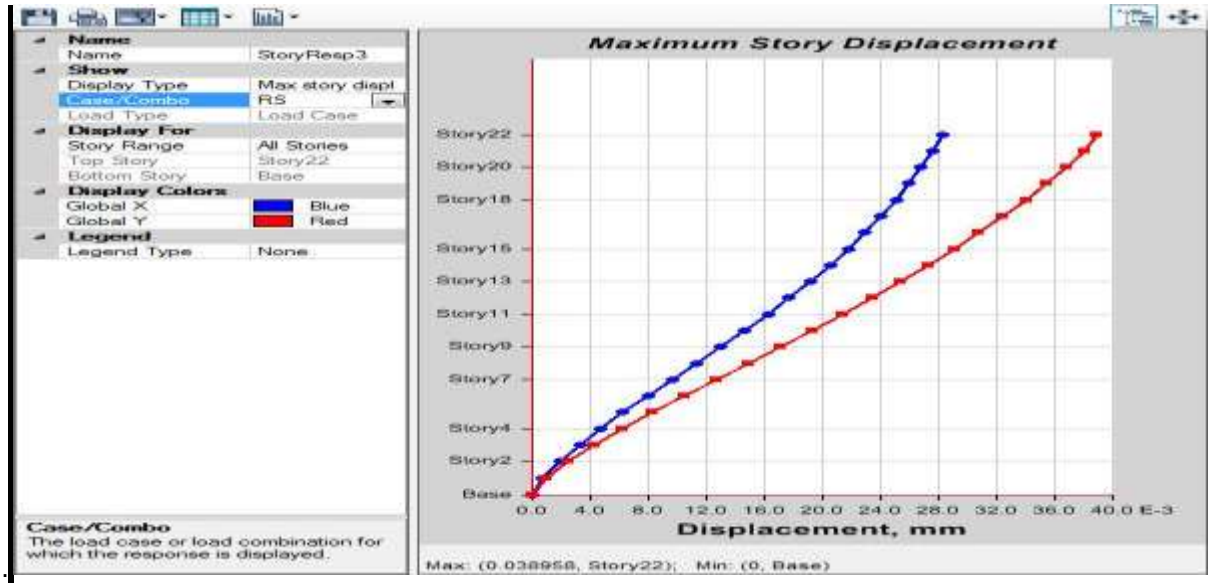
The high rise building cannot be considered a simple static method. It is a unique method to determine seismic loads. The equivalent static analysis is used to design only for the small structures.





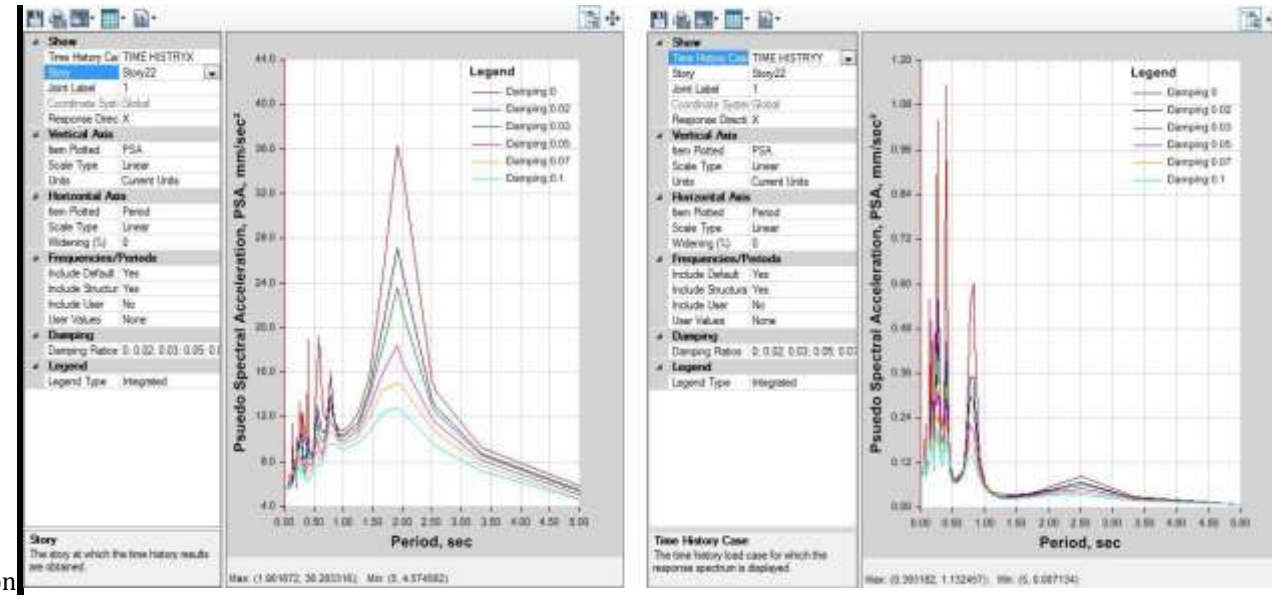
1.3.2 Response spectrum

It is linear dynamic method to determine from each natural mode of vibration to indicate the likely maximum seismic response of an essentially elastic structure. Response-spectrum analysis provides insight into dynamic behavior by measuring pseudo-spectral acceleration, velocity, or displacement as a function of structural period for a given time history and level of damping



1.3.3 Time history analysis

It is taken by historical data or values of index for the given by specific periods of time. These are data taken a future or forecasting rate movements. The time history data provides structure response under various loading cases to the specified.



time function

1.4 Conclusion

G+21 multi-story building have designed by computer aided application using E-tabs software for analysis the frame, slab and walls. These designs are taking best suitable data by analyzing the Indian standard code of earthquake resistant and also analysis the earthquake zone 3 in LUCKNOW areas. I have designed in the base of column & beam features. In earthquake building design more focus on building lateral forces and also consider the good flexibility joints between the beams and column.

- I have taken suitable data by analysis of Indian standard code provision and also study the earthquake zone 3 in LUCKNOW.
- All analysis before I have analyzed the joints of beams and column taking very carefully and also take more FOS then my building will be safe zone.
- In the earthquake condition beams & column width taking equal size so bonding between them very economically.
- Also my building G+21 in plan of beam & column joints by linear not offsets occurs because the offset can failure phenomenon.
- I can design proper and suitable data analysis so my building is economically very good.
- Also cast of building is reduces.

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