ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Issue 02, February 2018

Numerical Investigation on Skyscraper with Core and Post-Tensioning Slabs

C. Neeladharan[1], Mohammed Aashik.A[2], Mohmed Aslam. M[2], Zaid Safeer. R. K[2]

Assistant Professor, Department of Civil Engineering, C. Abdul Hakeem College of Engineering and Technology, Vellore, Tamilnadu, India [1]

UG Student, Department of Civil Engineering, C. Abdul Hakeem College of Engineering and Technology, Vellore, Tamilnadu, India [2]

Abstract: Structural design requires a full understanding and knowledge of all the components comprising the structure. Skyscraper is a high-rise multistory structure of more than 35 meter. The main element of a Skyscraper is Core structure system. Post-Tensioned slabs have been used in this structure to reduce the cost of construction by saving the required amount of reinforcement. Skyscrapers are normally designed for dead load, live load, wind load and seismic load and their Load combinations. All loading and unloading conditions in analysis and design are provided as per IS codal specifications. The whole modeling of Skyscraper was done in "ETABS" (Extended 3D Analysis of Building Structure) and "SAFE" (Software Analysis & Forensic Engineering) for carrying out the non-linear analysis of the combinational loads. The behaviors of each element under the effect of loads were studied from the output generated by the ETABS & SAFE. The output of the software presents results including moments, axial loads, shear force and displacements. Moreover, moments and axial load at each node and at any point within the element can be easily obtained from the software output. This thesis examines issues, analysis and design calculation over a structure with safety under all conditions.

Keywords: Skyscraper, Core, Post-tensioning slabs, ETABS, SAFE.

I. INTRODUCTION

A Skyscraper is a tall, continuously habitable building having multiple floors. When the term was originally used in the 1880s it described a building of 10 to 20 floors but now-a-days describes more than 20 floors. Mostly designed for office, commercial and residential uses, a skyscraper can also be called a high-rise, but the term "Skyscraper" is often used for buildings higher than 100 m (328 ft). For buildings above a height of 300 m (984 ft), the term "Super tall" can be used, while skyscrapers reaching beyond 600 m (1,969 ft) are classified as "mega tall". In Core Structural system Lateral and Gravity loads supported by central Core and it eliminates the columns and bracing elements. It allows all window space to be utilized as rental office space. It permits officers to varying depth to receive natural light. It is suitable in terms of access and in some cases may be equidistant from all sides. The central of arterial part of a multistory building that integrates functions and service needs for established occupants. Such areas are normally composed of toilet facilities, elevator banks, janitors' closet, utilities, mechanical facilities, smoke shafts and stair. Core also known as facade envelope is a spatial element for load bearing high-rise building system.

II. RELATED WORK

C.Neeladharan et al, studies the effect of designing against multiple hazards is more than doubly difficult when compared with designing against a single hazard, especially when those multiple hazards are wind and earthquake. Many favorable features of wind resistant design are unfavorable for earthquake resistant design and vice versa. Heavy structures resist wind better and light structures resist earthquake better. Flexible structures attract greater wind forces. Stiff structures generally attract greater earthquake forces. By adding shear wall percentage reduction of displacement can increase. **Acuto Michelle et al**, stated that the freedom of design of architectural works. As they concern about the safety guidelines of the people, the architectural works are limited to an extent and certain designs are avoided. The safety officials must make sure these places are safe to live, work, and play in. The environmentalist must ensure that the building does not

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Issue 02, February 2018

impose undue harm on its immediate surroundings. However, each cannot operate without affecting another. The environmental positives will also be economic gains, and vice versa. The concerns of the safety officials will also affect the well being of the inhabitants the architect is designing for. The perspective is then that policy makers should give architects the freedom to take risks and to produce spectacular buildings that are among humankind's great achievements, but with certain constraints.

III. Scope Of Research

The main scope of our research is to analyse the Skyscraper by using ETABS & SAFE and to design of Skyscraper using the values obtained from ETABS & SAFE Software.

IV. Description Of Building

- Number of floors : 25
- Each floor height : 3.5m
- Total height : 90m (295.27ft)
- Built-up area : 675 m^2 (7265.7 ft^2)
- Total floor area : 13500 m^2 (145314 ft^2)

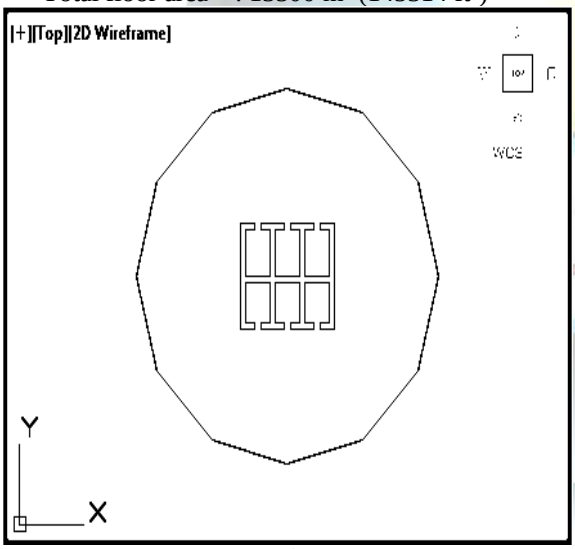

Fig -1: Plan of the building

V. Load Cases And Load Combinations

Load Patterns (from IS 875 & IS 1893: 2002)

1. Live Load (IS 875-PART 1)
2. Dead Load (IS 875-PART 2)
3. Seismic Load (IS 1893: 2002)
4. Wind Load (IS 875-PART 3)

Load Combinations:

A. Earthquake
   1. 1.5 (DL + LL)
   2. 1.5 (DL + EL)
   3. 1.2 (DL + LL + EL)
   4. 0.9DL + 1.5EL

B. Wind
   1. 1.5 (DL + WL)
   2. 1.2 (DL + LL + WL)

C. Combination of Earthquake and Wind Load
   1. 0.9 DL + 1.5 EL + 0.9 WL
   2. 0.9 DL + 0.9 EL + 1.5 WL

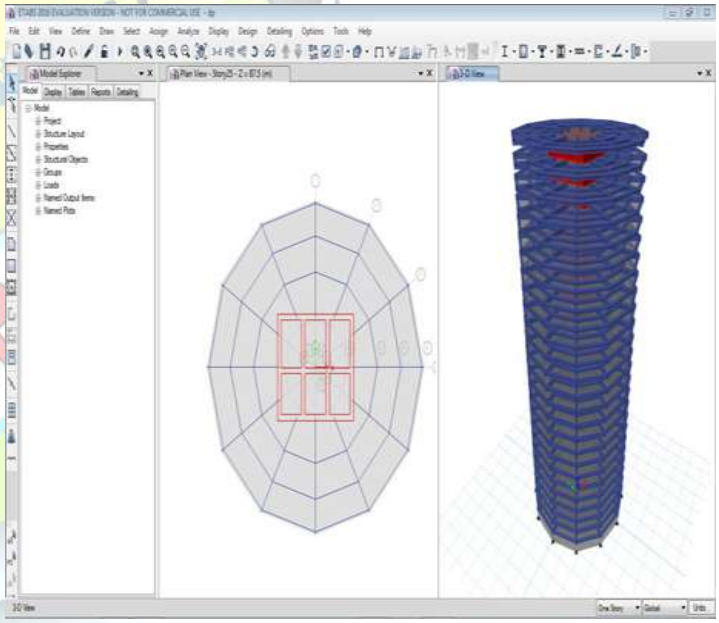

Fig-2: Pre-analysis view

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Issue 02, February 2018

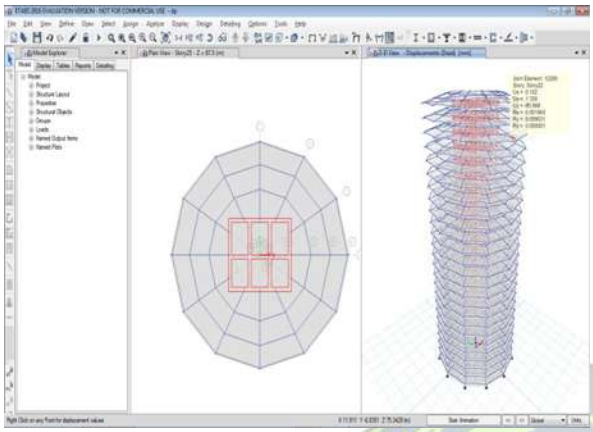

Fig-3: Post-analysis view

VI. Load Cases And Load Combinations

After running the analysis the element of the structure is verified and all the structural elements are passed under all load cases and load combinations. The completed stage of analysis of the Structure is shown in Fig.3

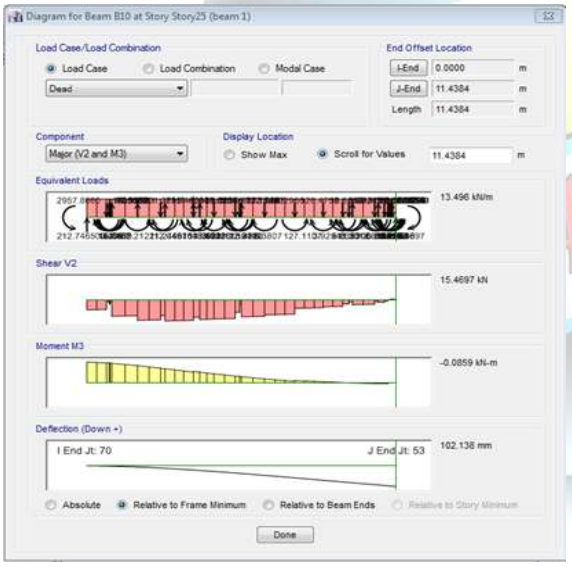

Fig-4: Shear force & bending moment diagram of primary beam

Fig-5: Shear force & bending moment diagram of secondary beam

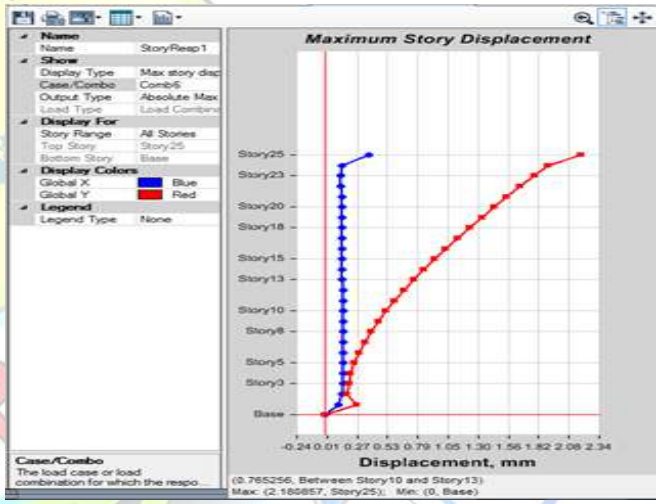

Chart-1: Story wise displacement

VII. Conclusion

Thus, we have analysed and designed a 25 Floor Skycraper with Core and Post-Tensioned Slabs using ETABS and SAFE. We have analysed the Structure with different Load Combinations as per IS 875 (Part 1-5): 1987 using Etabs for Core and Safe for Slabs & Beams. we concluded our result by having zero failures and all the members of the structure have passed safely under all load combinations.

References

[1]. IS 875 (Part 1 to 5) : 1987 – code of practice for design loads

[2]. IS 1893: 2002 – criteria for earthquake resistant design of structure

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Issue 02, February 2018

[3]. Bryan Stafford Smith, Alex coull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc., 1991.

[4]. Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, 2011

[5]. J. Rasigha and C. Neeladharan, "Design of Structures to Resist Multi Hazards," International Journal of Innovative Research in Science, Engineering and Technology, Vol 5, No 7, pp. 1 -6, April 2016.