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GLOBAL ANALYSIS OF TALL BUILDING WITH TUBED MEGA FRAME STRUCTURE

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Abstract – *On these days, high rise building is generally constructed with one core whose purpose is to transfers the loads from top to the foundation. The core is taking more space of floor which results in less space for the rooms which restrict actual purpose of building of malls, office and apartment. Because of that profit compromise. Moreover after some height the core cannot manage to keep the building stable by oneself. So that it requires to be joined with other structural system like outrigger to withstand the seismic or wind forces. So the structural system named tubed mega frame is designed by abolishing the core and making the perimeter frame which transfer all the loads to the foundation which makes structure more stable. The aims of the thesis to test the effectiveness of the tubed mega frame system against system are in present for high rise buildings. Analysis of Tubed mega perimeter frame and Tubed mega columns system will evaluate in this thesis*

***Key Words*: Tubed mega frame system, conventional system, ETABS**

1. INTRODUCTION

Due to growth in population in last decade demand of land is increase. This developments draw is to many disadvantages like pollution which create negative smash on the nature and also social problems like separation.

This population growth affect us in many ways but the main problem is land is limited but the growth of population has no boundary so in future all land will occupied and many people still remain homeless so to get rid of this situation tall building construction started. Which is the solution to meet the present demand and condition. Because of high rise building construction more people can acquire there house or residence at small amount of land.

Because of above stated problem construction of high rise building needed and the construction started in 1926.At that time the construction of building is totally based on masonry which require more space at base to fulfill the demand to get more height because of that it is not possible to build more than four or five story. As time passes and further study goes on this subject use of steel in masonry start to use which is called as frame system.

With this new frame system introduced in market the city becomes denser, and this system is also environment as well as social friendly.

Tall buildings are good for the residential as well as commercial use. The structural systems which are currently famous are as stated below. The main purpose of this structural system to withstand against horizontal forces.

1. Braced frame structure
2. Outrigger systems
3. Rigid frame structure
4. Shear wall frame structures
5. Tubular structures

The tubular structures has its own classifications like

i. Frame tube
ii. Braced tube
iii. Bundled tube
iv. Tube in tube
v. Tube mega frame structures.

Among all these structural system frame, braced and bundled tubes are quite old and tube in tube and tube mega frame are new as compared to others. Apart from this tube in tube structure is popular these days and tubed mega frames structure is newest in the list.

2. OBJECTIVES

(i) To understand the working of Tubed mega frame system against lateral Loading.

(ii) Model different cases for Conventional system and tubed mega frame system in a Structural analysis software like Etabs.

(iii) Compare Conventional system with tubed mega frame system for a High Rise Building.

(iv) Determine the efficiency of all the Conventional system against tubed mega frame system for different Configurations.

(v) Carry out comparison of all type of conventional system and their type for following parameters with p delta and without p delta.

1. Max Story Displacement

2. Eigen mode values

3. LITREATURE VIEW

Archana J, Reshmi P R, (2012) [1] investigated The tube in tube structure with center tube shows better result than that of bare frame and tubed mega frame structure, In static and response spectrum analysis tube in tube structure shows 46.98% and 48.6% reduction in displacement than that of bare frame and for tube mega frame 18.89% and 26.5% displacement reduction than that of bare frame, From comparison of analysis result tube in tube structure with center tube is recommended as a better structure system.

Shilpa Balakrishnan, Rona Maria Jame, and Hong Guan (2019) [2] investigated Story displacement, story drift and story shear are higher for tubed mega frames when compared with tube in tube under different geometry, Tube in tube will act as a better structural system than tubed mega frames for tall buildings Circular tube in tube is a better option for high rise buildings since it has less story displacement, story drift and story shear.

Subathra Kannan (2018) [3] analysed G+25 building structure has been modeled in Etabs, Conventional structure and frame tube structure are analyzed for dead load, live load and earthquake load with the help of Etabs, Conventional system like tube in tube and bundled tube system are analyzed and in frame tube system with and without interior column analyzed Concluded 20% to 33% reduction in zone 3, 23% to 44% in zone 4 and 23% to 37% in zone 5 ,observed in diaphragm displacement of frame tube structure, Story drift reduced for frame tube structure about 37% to 48% in zone 3, 44% to 49% for zone 4 and 46% to 49% in zone 5, Story shear for frame tube reduced about 2% to 4% for zone 3 , 4% to 8% in zone 4 and 10% for zone 5, as per response spectrum analysis, It is been observed from the above graphs and conclusion that percentage of lateral load such as Earthquake in x and y direction resisted by tube structure is more in comparison of conventional structure for all the three zones.

A Rakesh Arun Banne and S. N. Tande (2016) [4] G+39 story building is modeled with one internal tube ,two internal tube and three internal tube in Etabs. Concluded that Negative shear lag is present in the structure at 2/3 height from top, For one tube, two tube and three tube the first story axial force in corner column of the front flange of the building is more than in middle corner by 29.5%,22.5%,14.75% respectively, Framed tube structure shows better performance when internal tubes are used.

Reza rahgozar, Yasser sharif (2009) [5] analyze 30, 40 and 50-storey buildings are investigated for combined system of framed tube, shear core and belt truss, concluded that perimeter of the building is connected with belt truss and have in corner mega column so connecting all the members with belt truss on height H/6 it shows less displacement for all 30,40,50 story building as compared to belt truss at H/2 and 3H/4 location, In this system, the resistant moment and bending stiffness increase while lateral displacement of the structure decreases.

AREZO PARTOVI JENNY SVÄRD (2016) [6] compare all the conventional system with each other at 60 story building and illustrate that core outrigger and perimeter frame gives less value in displacement and performs better than other structural system.

4. METHEDOLOGY

4.1 MODELLING OF BUILDING

Here the study is carried out for the behavior of G+30, G+45 and G+60 storied building of different structural system like core, outrigger and perimeter frame and tubed mega frame. Floor height provided 3m. And also the properties are defined for the structure.

4.2 BUILDING PLAN AND DIMENSION DETAILS

The Following are the specification of G+ 30 ,45 and 60 storied building located in seismic zone IV resting on medium soil type 2with response reduction factor 1 at barmer location with terrain category 2 class of structure A. Buildings modeled using ETABS are shown in Fig: 2 to Fig:10.

Fig 1: Core outrigger perimeter frame

Fig 2: Tubed mega perimeter frame consist of belt wall

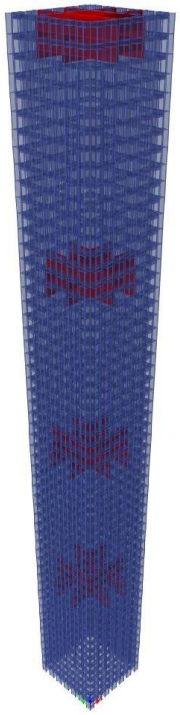

Fig 2: Tubed mega perimeter frame consist of cross wall

4.3 APPLIED LOADS

- Siesmic load in positive x direction
- Dead load
- Wind load

5. ANALYSIS OF BUILDING

Seismic parameters are considered as per IS 1893(Part 1):2016 location is selected barmer Rajasthan in zone iv soil type 2 importance factor 1 response reduction factor 5.
Wind parameter considered as IS 875 part 3 Location is barmer, wind speed 47 m/, terrain category 2 ,structure class A, k1 = 1 , k3 = 1, wind ward co efficient cp =0.8,leeward co efficient cp = 0.5.

6. RESULTS

6.1 STOREY DISPLACEMENT

Graphical representation of displacement values for all models as shown in Chart 1 and Chart 2.

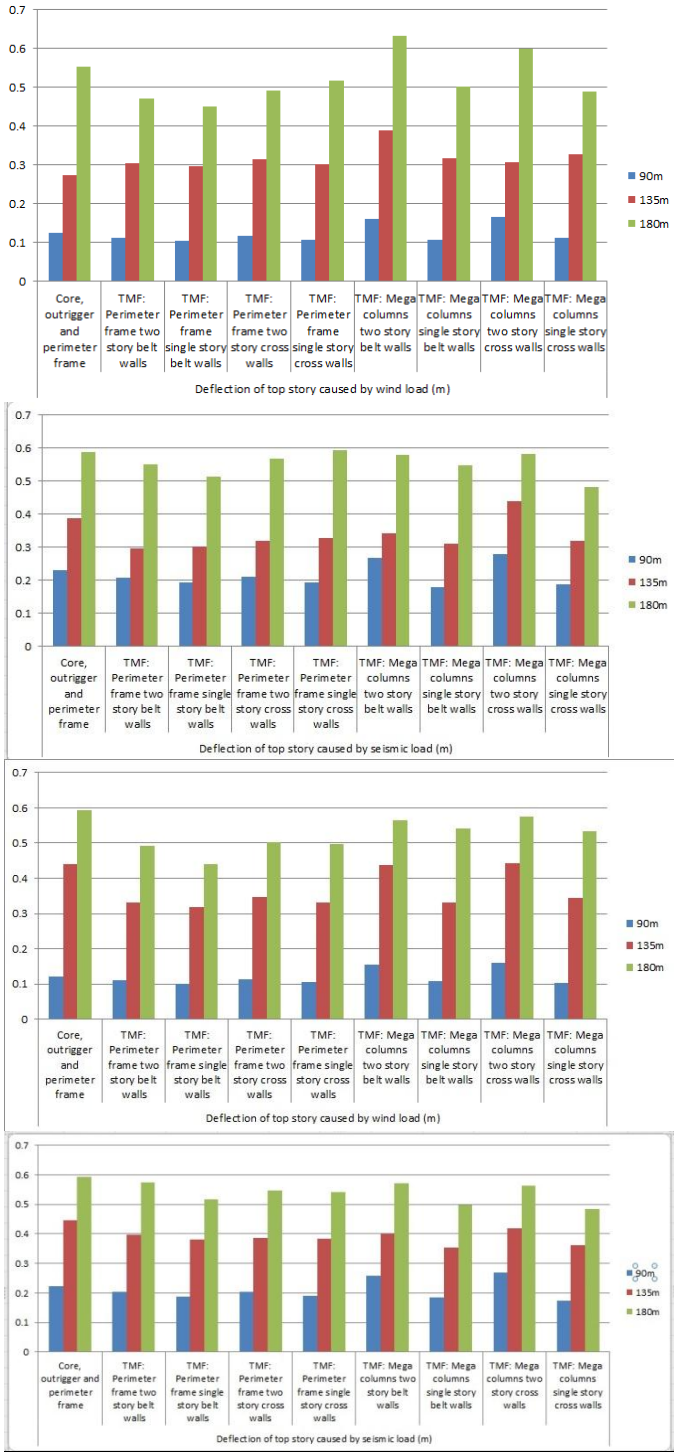

Chart1: Displacement bar chart of Model having deflection when subjected to wind load and seismic loading

7. CONCLUSION

From above obtained results we can conclude that as the height of the building increases tubed mega frame structure performs significantly well.

Also we can see that when wind laod is applied to the system tubed mega perimeter frame single story performs better and when seismic loading is applied to a system tubed mega column single story belt walls gives lowest displacement.

As height of the structure increases difference value of P- delta include and exclude also increases because as the height increases structure gain more mass which effect p delta.

From above result distance between belt and cross wall will effect severely on the deflection and period.

We also find that Tubed mega column single story belt wall is giving lowest value of Mode 1 and Mode 2 and core outrigger and perimeter frame giving lowest value of Mode 3 which means Tubed mega column single story is stable against lateral movement and Core outrigger and perimeter frame is more stable in torsional movement.

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