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A Performance Study of (G+20) RCC Structure Using Framed Bundled Braced Tube System under the Effect of Seismic Loads

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***Abstract** - Since 1890's, there is need for multi-storied building due to overcapacity of cities. The lateral loads (Seismic & wind forces) work as an main role in the construction of high rise structures. The tubular systems are different types in which framed bundled braced tube structures are more suitable for tall buildings. This study includes the structural behavior of framed bundled braced tube system under the effect of seismic loads. In this current thesis there are four models are analyzed as a safe & efficient in three dimensional structural analysis with same material, section properties & dimensions are assigned to the models and analyzed with the help of StaadPro V8i SS6 software by varying the different location of bundled braced tubes. Equivalent Static analysis is done. The different parameters like Base shear, Storey Displacement, Storey Drift, Bending Moment & Shear Force are considered to evaluate the output of plane frame and framed bundled braced tube system models and it is represented in the form of tables & graphs which will help us to understand the behavior of framed bundled braced tube system under the effect of seismic loads and also to suggest the better performance among the structures.*

Key Words: (Equivalent Static Method, High Rise Buildings, Seismic Loads, Tubular System, Framed Bundled Braced Tube System, StaadPro)

1. INTRODUCTION

The globe or world is getting in style steadily by constructing the high rise building. The construction technology and computers with the appearance of recent days, the fundamental aim has been to construct safer buildings and keeping visible the economical science of the project. The tall structures are affected more too lateral loads, to resist the loads which are considered as parameters of model. At the time of construction of multi storied buildings some safety measurements are considered like the structure how to be designed for seismic and wind forces, foundation type and life of structure. This study consists the tubular concept which will give more spacing for accessible, more resistant to the lateral loads. And we can go for high rise structure.

1.1 TUBULAR SYSTEM

"Seismic coefficient Method" is also termed as Equivalent Static Force Method. Seismic response for normal structures within elastic range can be studied using this method.

Tubular structures are utilized successfully and are getting a typical feature in tall buildings. Basic forms of tubular systems are as follows,

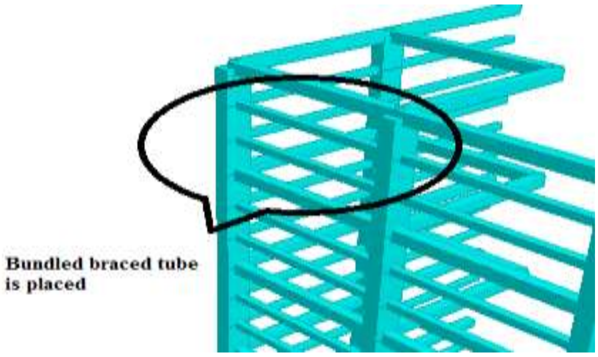
 Framed tube
 Framed bundled braced tube
 Bundled tube

1.2 FRAMED BUNDLED BRACED TUBE

To resist he horizontal or lateral forces, the tubes are introduced to the multi storied structures. A structure is designed to act sort of a hollow cylinder cantilevered perpendicular to ground. "Fazlur Rahman Khan" He is the man where the framed bundled braced tube system was introduced initial to the world. The very first tube structure is G+42 storey Dewitt-chestnut apartment building is built in Chicago by using tubes. Framed bundled braced tube is an improvement of tubular structure made by cross bracings the frame with X bracings over many stories. The example of framed bundled braced tube structure all around the world are Bank of China Tower in Chicago, Onterie centre in Chicago, Renaissance tower in Dallas, Pearl River town in Guagzhou,

Fig 1.0 Framed bundled braced tube Structure

The place of bundled braced tube for multi storied buildings at different locations is as shown in figure below



1.3 AIMS AND OBJECTIVES 0F THE PRESENT STUDY:

1) Main purpose of this present work is to investigate the performance of a framed bundled braced tube structures with different positioning of bundled braced tube.

2) To perform seismic analysis on bare frame & framed bundled braced tube systems using StaadPro V8i SS6 software.

3) To advocate best bracing system for good performance of RCC structures by considering the framed bundled braced tube system among the various models.

1.4 METHODOLOGY:

1) The report will start with in the form of modeling and analysis, using equivalent static method by the software StaadPro V8i SS6, by using the respective IS codes.
2) The above report along with the assumed cases of RCC Structures of with the framed bundled braced tube at different locations of the models, by optimizing the structures with using the respective IS codes.
3) Finally, the report ends with results of, a comparison between the frame buildings with framed bundled braced tubes at different locations of the models using tubular structural system.

2. LITERATURE REVIEW

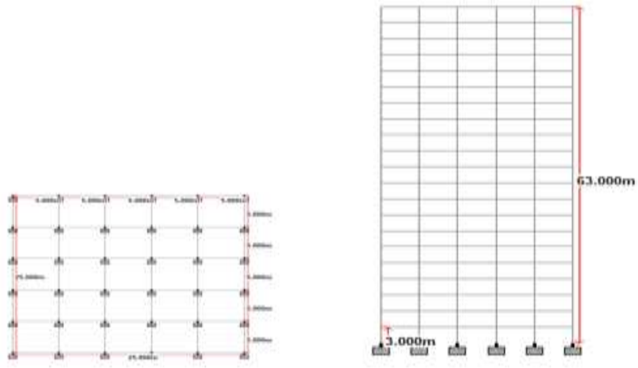
FAZLUR R.KHAN. (2003) - The study is carried out to check the continuous interaction between the development of structural system and architectural concepts. The author was described G+99 multi storey building, the total height of the each floor is 3m and the overall height of the building was 330m. In this structures they were used the braced tube system, when compared to a traditional frame building of 30 to 40 storey building This published thesis described that the respected building gave overall legal, integrity features to the building by designing and providing the bundled tubes @ periphery of the building.

Nimmy dileep (2015): In this study the author was selected tube in tube structures to check the seismic behavior by designing the three models with the help of SAP 2000 Software software by varying location of the thinner tubes. And is done by using time history analysis method, response spectrum analysis method and by equivalent static method. And the output of three models is evaluated to have a comparative study of tier seismic performance. From the above results or come out it is tobe said that time history analysis predict the structural response more accurately than equivalent static analysis and response analysis.

Archana J (2016): In this study 16 story RC building was considered. The structures was exactly 48.30m, tall and is 23.OO m wide and 34.45Om length, and the publisher was used the Etabs Software for seismic and wind load performance on structure.. Here mainly static and repose spectrum analysis are carried from result comparing bare frame structure to other two systems .Finally by above come out results the tube in tube structure with cores tube is recommended as a structural system for tall building than plane frame structures and tube mega frame systems.

3. MODELLING AND DETAILS OF STRUCTURES

For main models of our thesis is to study the seismal behavior of RCC structures by using framed bundled braced tube system with different bundled tube bracing arrangement, the G+20 multistoried RCC building is considered using StaadPro V8i SS6 software. In this project a G+20 RCC building is taken out for analysis. The plan and elevation of respected model is shown (Area 25m X 25m), the bay sizes along both the axes i.e., **X & Y** is taken as 5.0 m C/C. The floor to floor height is considered as 3m.

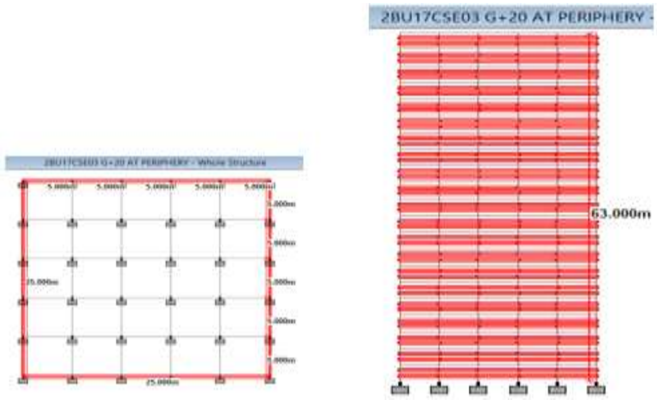


Model 1.Plan and elevation of the building for Plane Frame

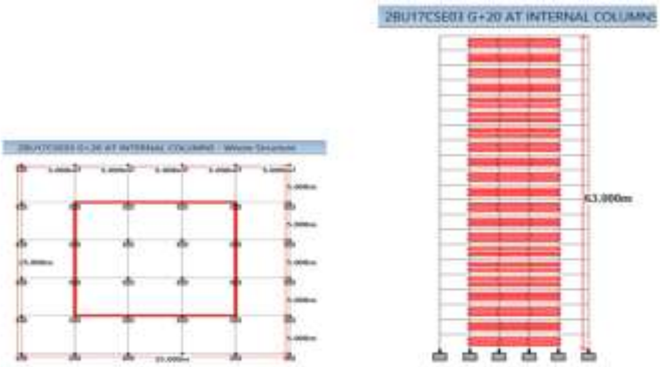
Structural Member	Size(mm)
Columns for GF	450X 750
Columns on 1st to 5th floor	450 X 750
Columns on 6th to 20th floor	400 X 700

Beams for all floors	320 X 300
Thickness of slab	150
Bundled braced tube bracing	100 X 100

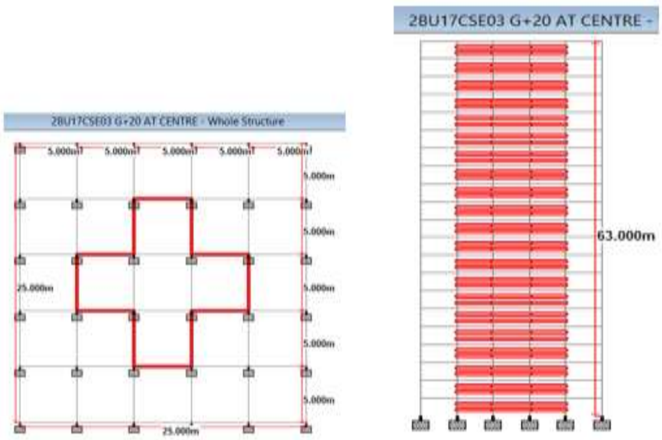
Table No I. Sizes of Structural Members



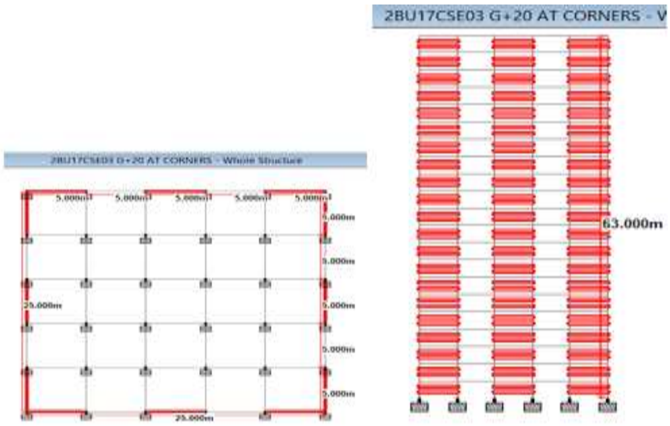
Model 2.Plan and elevation of the building for Bundled Braced Tube @ Periphery



Model 3.Plan and elevation of the building for Bundled Braced Tube @ Internal Columns



Model 4.Plan and elevation of the building for Bundled Braced Tube @ Centre



Model 5.Plan and elevation of the building for Bundled Braced Tube @ Corners

4. RESULTS AND DISCUSSIONS

From the seismic behavior of RC Structure with and without bundled braced tube arrangements, the results are 0btained from the software (StaadPro V8i SS6) are discussed & observed.

Table No II. Base Shear in (kN)

Floors	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5
G.F.	0.429	0.425	0.426	0.427	0.420
5TH	15.294	16.45	15.98	15.99	15.97
10th	50.86	55.09	53.36	53.40	53.33
15th	107.6	116.9	113.1	113.2	113.1
20th	175.7	195.7	187.5	187.7	189.0

Table No III. Roof Displacement in (mm)

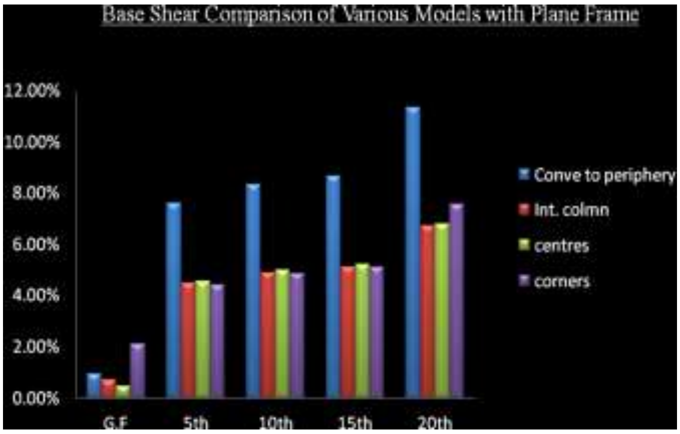
Floors	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5
G.F.	2.929	2.644	2.500	2.26	2.748
5TH	51.596	32.411	41.303	37.696	38.616
10th	108.64	64.428	84.023	78.398	79.521
15th	154.61	90.572	118.54	111.80	114.15
20th	179.11	104.66	137.91	130.29	135.00

Table No IV. Storey Drift in (mm)

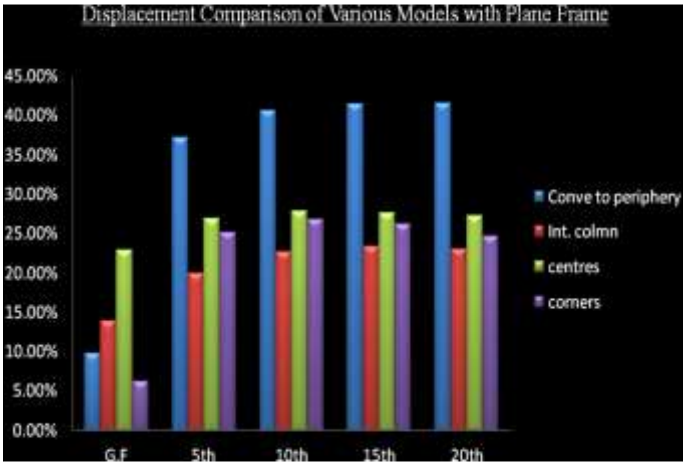
Floors	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5
G.F.	2.929	2.644	2.500	2.26	2.748
5TH	11.42	6.476	8.83	8.203	8.086
10th	10.909	6.14	8.093	7.801	7.954
15th	7.734	4.441	5.903	5.705	6.016
20th	3.278	1.877	2.78	2.528	3.101

4.1 Discussions

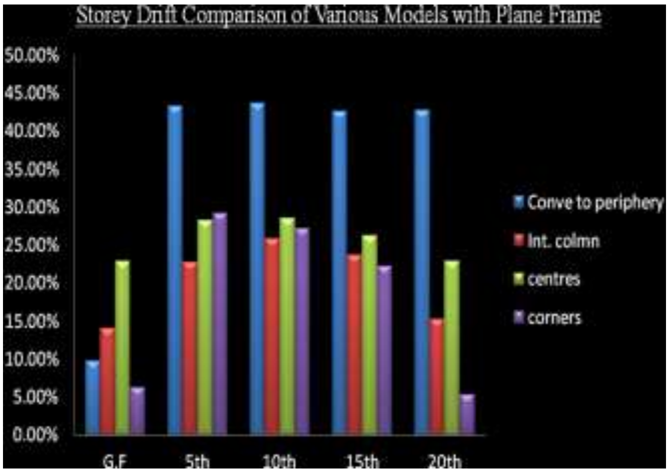
Graph No I. Base Shear Comparison of Various Models with Plane Frame



Graph No II. Roof Displacement Comparison of Various Models with Plane Frame



Graph No III. Storey Drift Comparison of Various Models with Plane Frame



5. CONCLUSIONS

A) Base Shear:

Maximum base shear developed @ the ground floor for all the models. By considering the top floor(20th floor) of the structures the maximum base shear exist in bundled braced tube @ periphery of the building compared to all models & minimum in bundled braced tube @ internal columns of the building which is 6.72% more than that of plane frame model.

B) Roof Displacement:

From the outcome it can be concluded that plane frame model will have maximum roof displacement which is 179.111mm and the minimum roof displacement of bundled braced tube @ periphery of the model which is 104.661mm i.e., For Top Floor, the displacement is decreases by 41.57% in Bundled Braced Tube @ Periphery of the building compared to plane frame building.

C) Storey Drift:

Particular stories may show excessive lateral (horizontal) displacement. So It can be concluded that by reducing the structure story drift, the likelihood of building collapse can be reduced. i.e., For top (20th) Floor, the storey drift is decreases by 42.73% in Bundled Braced Tube @ Periphery of the building compared to plane frame structures.

According to above parameters conclusions, **the bundled braced tube @ periphery of the building** is best bracing position for good performance of RCC structure building by considering the framed bundled braced tube system for safer & economical & for more economical we can go for **the bundled braced tube @ centre of the building**.

SCOPE FOR FURTHER STUDY

1). This project can be done by considering different material property such as for steel structures, for towers etc.
2). The present project can be done by taking other suitable floor to floor height and also we can increasing the geometry of structures.
3). It can be possible by providing the core system for all same models.
4). We may be use different dimensions of bundled braced tube for the models for the purpose of reducing the deflection of the respective building.

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5] IS Codes Such as IS 1893-2002 (Part 1), IS 875 (Part 1, 2 and 5).

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