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Analysis of Core Structural System of High Rise Steel Building by Changing Sections

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ABSTRACT

The commercial sector demands, building that are rapid to construct, of high quality, flexibility and adaptable in application and energy efficient in use. In this work the design of high rise steel structure is carried out and the different structural system of high rise building is studied. There is different type of structural system depends on the high of building and other parameters it is used. For the optimum design changing the section of the building and design is carried out by using ETABS software and design results are compared to each other. Different parameters of earthquake force and wind force is checked after design.

Keywords: High rise building, ETABS software, Structural system.

I.INTRODUCTION

Steel is a material having high strength per unit mass. Hence it is used in the construction of column-free space structures. Steel structures are built in a very short time as time is an important consideration, which are widely used in the construction of industrial buildings. An industrial building is usually a single storey steel structure with or without mezzanine floors. Brick masonry, concrete walls or GI sheet coverings may be the enclosures of these structures. Generally the walls are non-bearing but sufficiently strong enough to withstand the lateral forces caused by wind or earthquake. These buildings can be categorized as Pre-Engineered Buildings (PEB) and Conventional Steel Buildings (CSB) according to the design N concepts. PEB's are nothing but steel buildings in which excess steel is avoided by tapering the N sections as per the bending moment's requirement. If we go for regular steel structures, time required and cost will be more which together makes it uneconomical. Thus these buildings are fabricated fully in the factory after designing and then brought to the site. All the components are erected at the site with nut and bolts system which in total reduces the time needed for the completion of the structure.

II.MODELLING

The steel building used in this study is twenty four (G+23) storey building having same floor plan as shown in figure 1. The storey height is 3.1m for all floors and 3.575m for basement. The basement is considered as concrete structure. The live load is taken 5KN/m^2 for all floors. Thickness of slab is taken as 0.120 m. The thickness of brick

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wall over all floor beams is taken as 0.23 m. The unit weight of reinforced concrete is 25 KN/m^3 and masonry is taken as 20 KN/m^3. The compressive strength of concrete is 35N/mm^2 and yield strength of steel is 500 N/mm^2. The modulus of elasticity of concrete and steel are 25000 N/mm^2 and 2 X 10^5 N/mm^2 respectively. The steel grade is taken as fe 375. All the above mentioned building frames are analyses as per requirement of IS 800 and IS 1893. The structure has been considered to be located in seismic region III with an importance factor 1.5 and sub soil type 2 (medium). Analysis is carried out on building models using the software ETABS. The load cases considered in the analysis as per IS 1893-2002.

The structural systems in the building are the core of the robustness of the building above the ground. This structural system serves to hold and channel the horizontal and vertical force load evenly on the core structural systems and supporting structures, so that the building can bear the horizontal and vertical load as well as lateral force.

Following two models by changing section are considered for the analysis and design as per limit state design.

1. Using I- section
2. Using box section

III.LOAD COMBINATIONS

Load and load combination as given as per Indian standards. (IS 875-1984, IS1893-2002 and IS 800-2007)

I. Gravity loading

Floor load and member weight are calculated as per general considerations as per IS 875 part 1. Live load is taken for public building as 5 KN/m^2 as per IS 875 part 2.

II. Seismic loading

Seismic load is given as per IS 1893-2002. Following assumptions used for the calculation

Zone factor -0.16

Soil type -2 (medium soil)

Importance factor -1.5

Response reduction factor -5

III. Wind loading

Static wind load is given as per IS 875

Wind speed -39m/s

Terrain category -3

Class –C

IV. Wall loading

Density of brick loading is taken as 20 KN/mm^3

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Wall thickness -0.23m

Height of wall -3.1m

Total wall load -18.64 KN/m^2

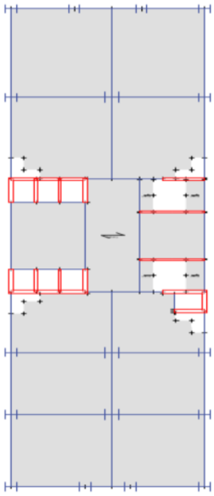

Fig. 1 Plan of Building

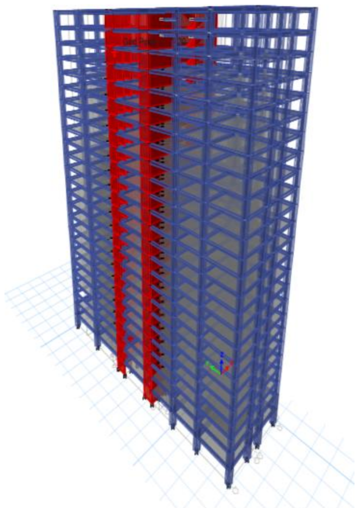

Fig.2 3D view of Building

IV.RESULT AND CONCLUSION

All loads and load combinations are considered for the comparison but result are presented for maximum load case.

Table 1 Results

	I section	Box section
Lateral displacement	15.232 mm	20.827mm
Storey shear	1022 KN	994.43 KN
Storey drift	0.0008	0.00099

From the results it is clear that lateral displacements in the I- section is less than box section. Storey shear is greater in I section than box section and storey drift is less as compare to box section. I -section gives better result than box section.

V.ACKNOWLEDGEMENT

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