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Comparison of Building in Sloped Area with and without Outrigger

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Abstract - *In this study, G+ 30 storey RCC building at slope with and without outrigger have been considered for the analysis. Outrigger is a lateral load resisting system, in which the external columns are tied to the central core at one or more levels. The outrigger system is commonly used as one of the structural system to effectively control the excessive drift due to lateral load, so that lateral load due to either wind or earthquake load, the risk of structural and non-structural damage can be minimized.*

The research aims to determine the effect of outrigger in a building. From the acquired results the effective performance of building with outrigger is evaluated. The modelling and analysis of the building has been done by using structure analysis tool ETAB 2015.

Key Words: **-** Outrigger, Response spectrum method, Storey drift, Storey shear, Lateral displacement, Overturning moments

1.INTRODUCTION

Nowadays there is an increase in construction of tall and slender structures both in residential and commercial area. The effect of lateral loads like wind loads, earthquake loads and blast forces are more on these type of structures. So it is very important to design tall and slender building with adequate strength and stability against lateral loads. But as the height of the building increases tall buildings with only shear wall is not capable of withstanding large seismic forces when it go to top levels. So it is necessary to provide an extra structural element in accordance with the shear wall which reduces the total seismic effect on the structure. Outrigger system is best suited for reducing seismic effects in tall and slender buildings. This study aims to understand the influence of outrigger in seismic resistance of a G+30 storied building. The main objective of this study is the comparison of building in sloped area with and without outrigger. The main objective of this study is as follows

- To find the effect of outrigger in a building.
- To make a comparison between with and without outrigger in a building.
- To analyze the building with and without outrigger using ETABS 2015

2.SOFTWARE UESD

*ETabs(*Extended three dimensional analysis of building systems*).*ETabs is a program for linear, nonlinear, static and dynamic analysis, and the design of building systems. ETabs is the most effective software for doing seismic analysis.

3.MODELLING OF BUILDING

In the present study a three-dimensional 30 storey building with 4m x 4m central shear wall is considered. The typical floor height is 3m giving a total height of 90m. The beams, columns and shear walls are assumed as concrete structure. Column and beam sizes considered in the analysis are 1m x1m and 0.4m x 0.6m respectively. The shear wall thickness is 0.23m.

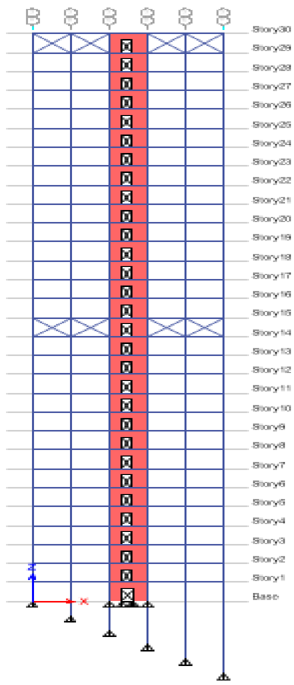

Fig-1: Building with outrigger

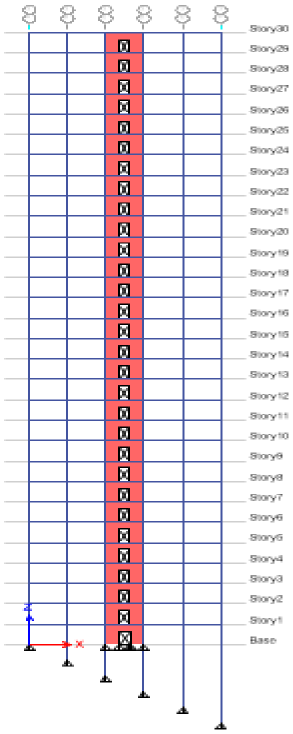

Fig-1: Building without outrigger

4. ANALYSIS OF THE BUILDING

For determining the static behavior ,the analysis is carried out for lateral wind load conforming to IS-875-part3 (1987) and analysis for seismic in accordance with IS 1893-2002 has been carried out.

Table -1: Building configuration

Total height of the building	90m
No. of stories	30
Height of each storey	3m
Grade of concrete	M30
Grade of steel	Fe 415
Depth of slab	0.150m
Size of beam	0.4m x 0.6m
Size of column	1m x1m
Thickness of shear wall	0.230m

Table -2: Seismic loading

Zone	II (moderate)
Zone factor	0.16
Importance factor	1.5
Response reduction	5

Table -3: Wind loading

Wind speed	39 m/s
Category	*2*
Class	B
Risk factor	1

5.RESULT AND DISSCUSION

5.1Building with Outrigger

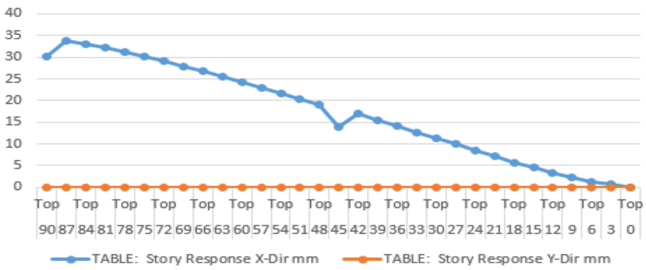

Chart -1: Maximum Lateral Displacement

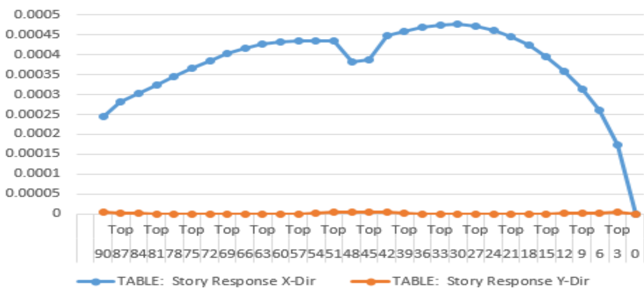

Chart -2: Storey drift

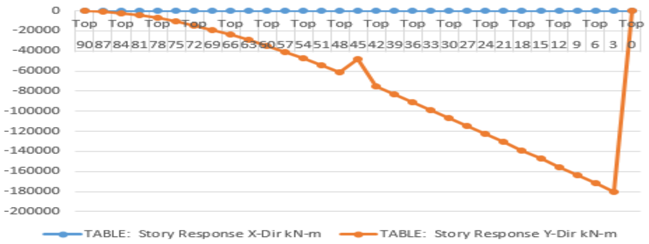

Chart -3: Overturning Moment

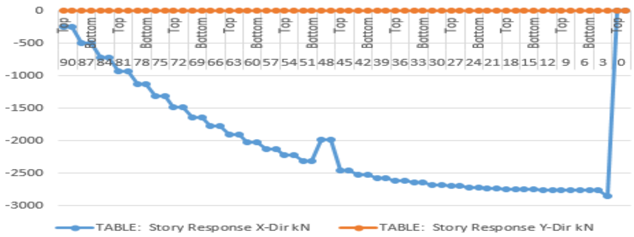

Chart -4: Storey Shear

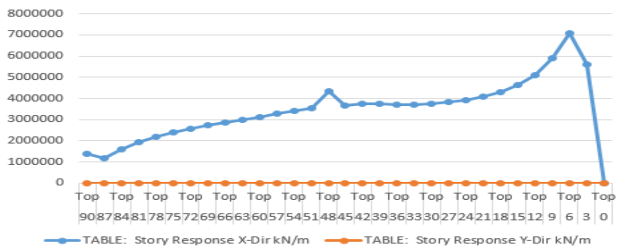

Chart5: Stiffness

5.2Building without Outrigger

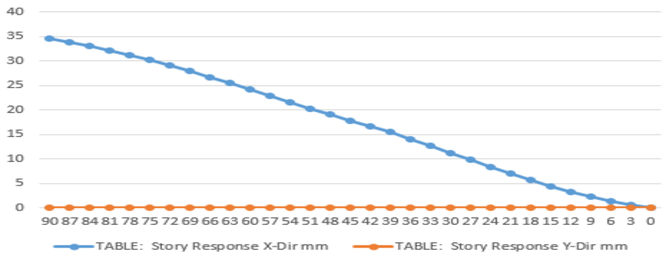

Chart -6: Maximum Lateral Displacement

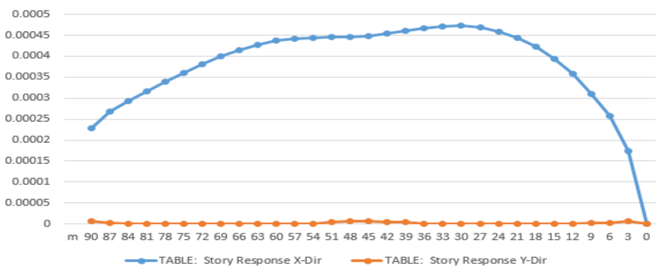

Chart -7: Storey drift

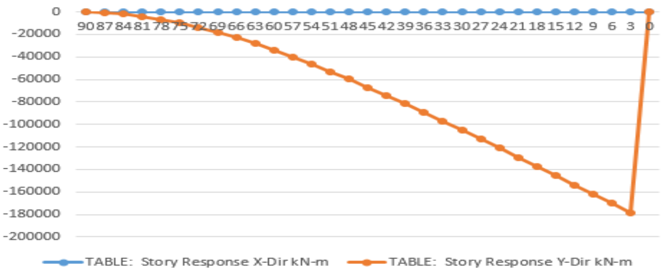

Chart -8: Overturning Moment

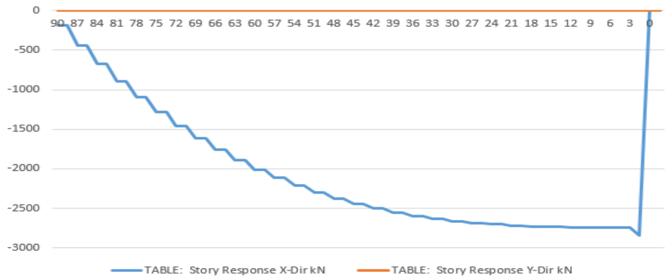

Chart9: Storey shear

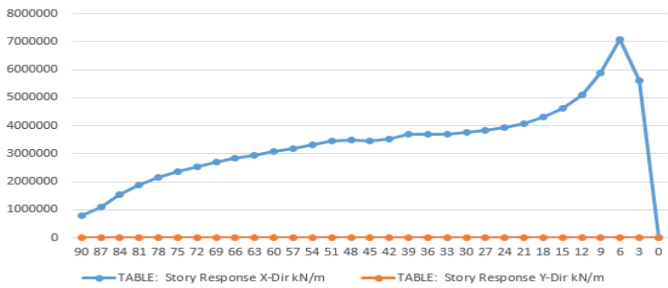

Chart10: Stiffness

6. CONCLUSIONS

From the analysis of regular building by response spectrum method, the following conclusions are obtained

- Building with outrigger, reduces Maximum lateral displacement about 20 %
- Building with outrigger, reduces Storey drift about 12%
- Building with outrigger ,reduces Overturning moment about 32%
- Building with outrigger reduces Storey shear about 24 %
- Building with outrigger increases Stiffness about 23%

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