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DYNAMIC ANALYSIS OF REGULAR AND IRREGULAR BUILDINGS WITH AND WITHOUT SHEAR WALL IN ZONE-III

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Abstract -Construction of Multi story Buildings is common in the present days due to the availability of limited space, growth of population and high cost of lands. Hence to safeguard the construction, the buildings to be constructed must be designed in such a way that it should withstand both gravity loads as well as lateral loads (earthquake, wind and blast load). The present study is done by providing the shear wall to the RCC building to gain the necessary stability, strength and also the stiffness to resist the loads coming horizontally i.e., Earthquake load. Here both regular and irregular shaped building is analysis by providing with or without shear wall. The results are studied for Response spectrum method using ETABS 2018. The proposed building is situated in the seismic Zone III and soil type II and the attempt is made to reduce the displacement with the introduction of structural shear wall system. The parameters considered in this study are storey displacement, storey drift, storey shear, storey over turning moments & storey stiffness.

***Key Words*:** lateral loads, shear wall, seismic Zone, storey drift, storey shear, storey over turning moments, storey stiffness.

1. INTRODUCTION

The buildings as subjected to both vertical and lateral loads, the structural system of the building as to resist these types of loads. It has been established that the design of multi-storey building is governed by lateral loads and it should be a prime concern of the designer to provide adequate safety of structures against these kinds of loads. Earthquake and wind loads are the lateral type of loads. Earthquake is unpredictable and occurs irrespective of time and location and our country as experienced many earthquakes resulting in severe damage to structure and loss of life. Hence, the design engineers should consider all these aspects and design for safety of structures.

1.1 Shear wall: Shear walls are vertical elements of the horizontal force resisting system. Shear walls are constructed to counter the effects of lateral load acting on a structure. When shear walls are designed and constructed properly, and they will have the strength and stiffness to resist the horizontal forces. Shear walls are especially important in high-rise buildings subjected to lateral wind and seismic forces. Shear wall buildings are usually regular in plan and in elevation.

1.2 Brief description about static and dynamic loads:

Static: These are forces that are been gradually applied loads and remains in the place for a longer duration of the time called static. This are not time dependent or least times dependent, live loads acting the structure is consider as the static loads because differs gradually in position, magnitude etc. Similarly the moving loads may also been considered as statically applied loads.

Dynamic: The structure which acts on the smaller interval of time or time dependent or quick change in the magnitude and direction known as dynamic, earthquakes loads, vibrations of machinery and blasting loads are the examples of dynamic loads

2. OBJECTIVES

- To analysis structure of 10 stories by using E-tabs 2018 tool
- To study the static and dynamic load of the buildings by seismic analysis
- To study the lateral forces for Seismic Zone Factor Zone III (Z-0.16)Ecc ratio-0.05as per IS 1893:2016
- To Analyze Wind Loads as perIS875:2015
- To analyze the structure of regular Size with RC framed buildings without shear wall and to locate the effect for seismic Analysis.
- To analyze structure of regular Size with RC frame building with shear wall and locate effect for seismic Analysis.
- To analyze the structure of Irregular Size with RC framed building without shear wall and locate effect for seismic Analysis
- To analyze the structure of Irregular Size with RC frame buildings with shear walland locate effect for seismic Analysis

- Comparison of RC frames response of tall buildings with different types of lateral force resisting system.
- To compare the lateral loads response of model-I, model-II, model-III and model-IV

- Model I: Regular frame with-out shear wall.
- Model II: Regular frame with shear wall
- Model III: Irregular frame with-out shear wall.
- Model IV: Irregular frame with shear wall

3. BUILDING MODELING

In this study G+10 Building is considered with soil Type-II and Seismic Zone-III, Shear wall is considered for regular and irregular plans and comparison is done between the bare frame model and shear wall model for both regular and irregular building using E-tabs software.

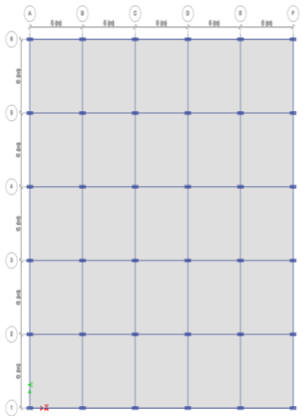

Fig 1: STRUCTURAL PLAN OF MODEL-1

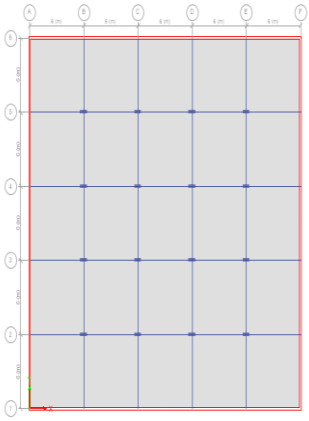

Fig 2: STRUCTURAL PLAN OF MODEL-2

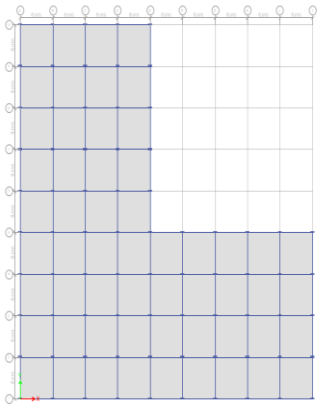

Fig 3: STRUCTURAL PLAN OF MODEL-3

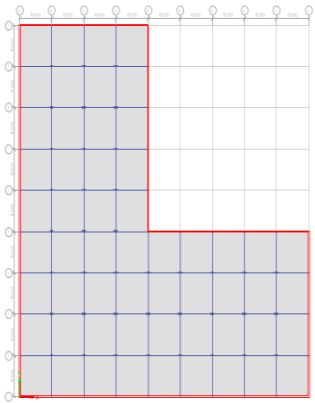

Fig 4: STRUCTURAL PLAN OF MODEL-4

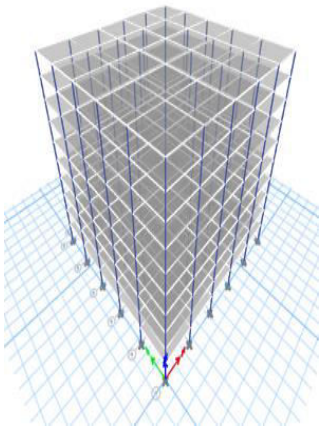

Fig 5: STRUCTURAL 3D VIEW OF MODEL-1

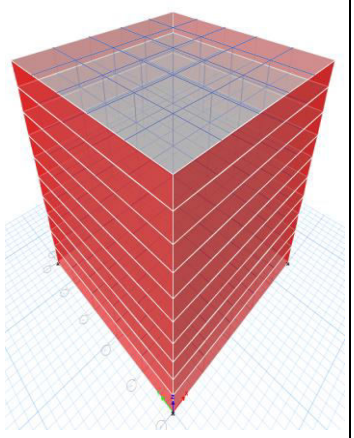

Fig 6: STRUCTURAL 3D VIEW OF MODEL-2

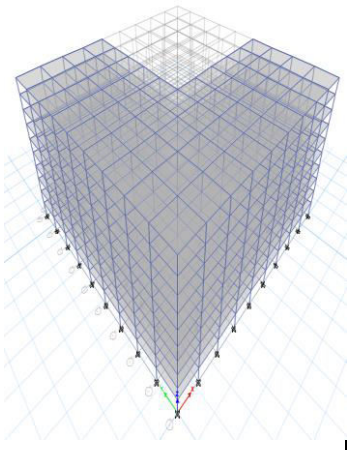

Fig 7: STRUCTURAL 3D VIEW OF MODEL-3

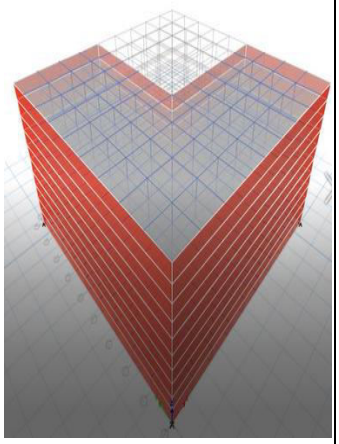

Fig 8: STRUCTURAL 3D VIEW OF MODEL-4

3.1 Description of the models:

SI.No	Particulars	Dimensions/size/value
1	No ofstorey's	10
2	Grade of concrete • For beams and slab • For Columns	 M35 M35
3	Grade of steel	Fe 500
4	Floor to floor height	3.3 m (GF) 3 m (other)
5	Beam dimension	300mmX600mm
6	Column dimension	300mmX900mm
7	Thickness of slab	150mm
8	Thickness of wall	230mm
9	Thickness of shear wall	200mm
10	Concrete density	25kN/m^3
11	Masonry density	20kN/m^3
12	Soil type	II(Medium)
13	Zone factor	III

4. RESULTS AND DISCUSSIONS

Table No 1: Variation of Max Displacement (mm) in X-X and Y-Y direction for Models 1 to 4Under different types of lateral forces resisting systems.

SI.No	MODELS	Max Displacement (mm) @	
		X	Y
1	Model-1	8.143	11.692
2	Model-2	0.587	0.593
3	Model-3	8.555	12.144
4	Model-4	0.793	0.805

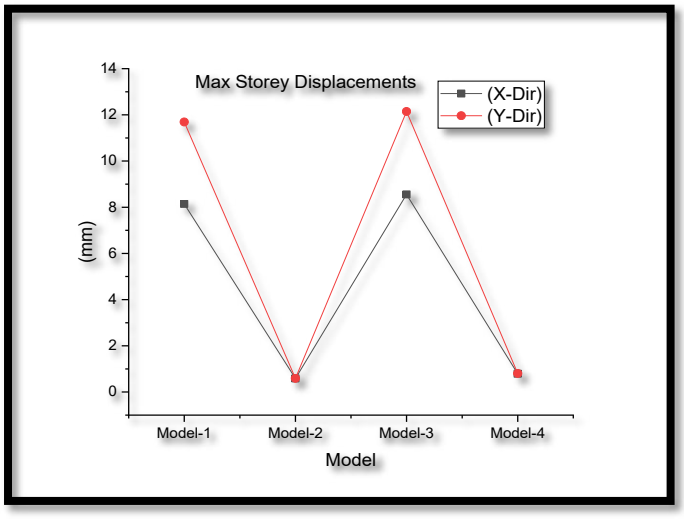

Chart 1: Max storey displacement for irregular building without shear wall(Model 3)

Table No 2: Max Storey Drifts for all models along X & Y axis

SI.No	Models	MAX Drift @X	MAX Drift @Y
1	Model-1	0.000395	0.000586
2	Model-2	0.000025	0.000024
3	Model-3	0.000419	0.000607
4	Model-4	0.000035	0.000034

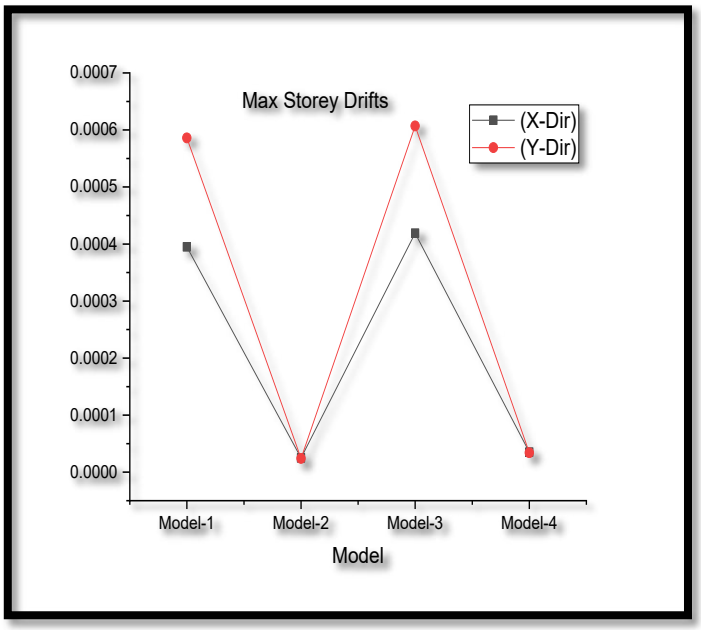

Chart 2: Max storey drift for irregular building without shear wall(Model 3)

Table No 3: Tabulation of Max. Storey Shear

SI. No	Models	Story Shear @X In KN	Story Shear @Y In KN
1	Model-1	1075.53	792.73
2	Model-2	2505.19	2413.12
3	Model-3	2341.74	1742.44
4	Model-4	5215.05	5245.95

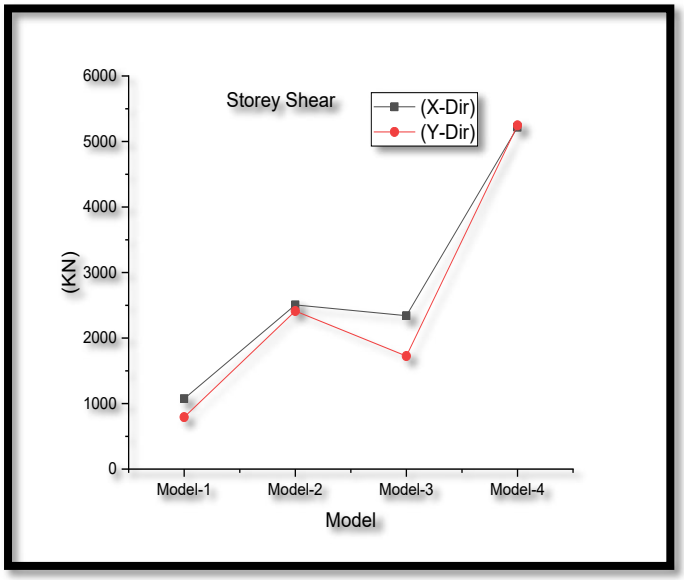

Chart 3: Max storey Shear for irregular building with shear wall(Model 4)

Table 4: Tabulation of Storey Stiffness for all models along X & Y

SI.No	Models	Storey Stiffness@ KN-M	ACCELERATION @ Y(mm)
1	Model-1	1512621	1306.01
2	Model-2	35408842	1502.7
3	Model-3	3288313	1276.18
4	Model-4	60293800	931.4

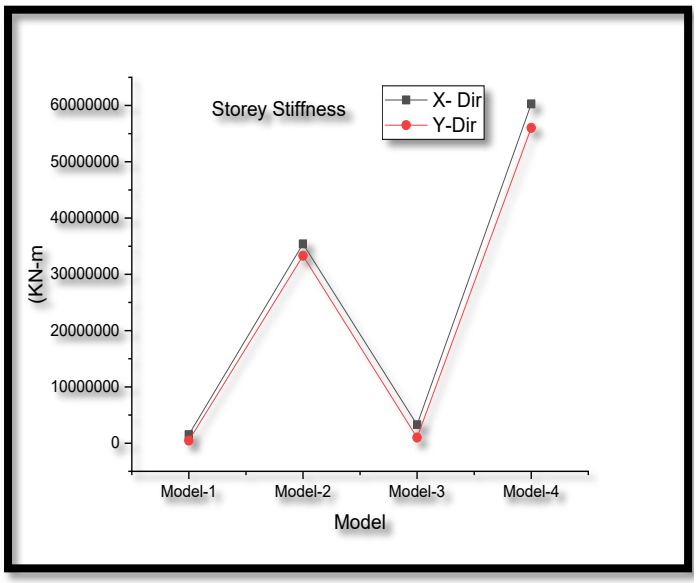

Chart 4: Max storey Stiffness for irregular building with shear wall(Model 4)

Table 5: Tabulation of Max. Storey over turning Moments for all models along X & Y.

SI. No	Models	Storey Stiffness@ KN-M	ACCELERATION @ Y(mm)
1	Model-1	15177.38	21586.07
2	Model-2	51287.87	51220.26
3	Model-3	33012.38	46994.29
4	Model-4	106956.16	106648.48

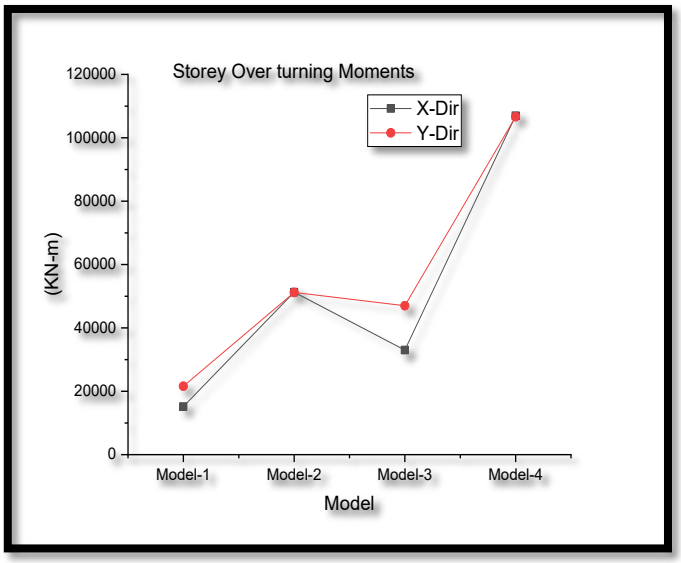

Chart 5: Max storey over turning Moments for irregular building with shear wall(Model 4)

5. CONCLUSIONS

1. As the shear wall resists the lateral force, the lateral displacement is more in normal and unusual construction without shear wall compared to regular and unusual shear wall construction, so the displacement is less.
2. Standard shear wall displacement construction is decreased by 6.97 percent and5.07 percent relative to standard shear wall-free construction in the X and Directions, respectively.
3. Irregular shear wall displacement construction is decreased by 9.3 percent and 6.63 percent relative to irregular shear wall-free construction in the X and Directions, respectively.
4. Standard shear wall drift construction is reduced by 6.32 percent and 4.09 percent relative to standard shear wall-free construction at X and Y Direction, respectively.
5. Irregular shear wall drift construction is lowered by 8.36 percent and 5.06 percent relative to irregular shear wall-free construction in the X and Y directions, respectively.
6. The weight of the structure is higher in the structure of the shear wall because of the rise in base shear, which would give earthquake output even better.
7. Standard shear wall shear construction is 42.9 percent and 32.85 percent higher compared to regular shear wall-free construction in the X and Y directions, respectively.

8. As compared to Irregular building without shear wall at X and Y direction, irregular building with shear walls storey shear is 44.9 percent and 33.2 percent more.
9. Regular shear wall construction with floor stiffness is 4.29 percent and 1.4 percent higher compared to regular shear wall-free construction in X and Y directions, respectively.
10. As opposed to Irregular building without shear wall at X and Y Direction, irregular building with shear walls storey stiffness is 5.45 percent and 1.78 percent more.
11. In normal and irregular construction with shear wall, overturning moments would-be higher compared to the standard and irregular construction without shear wall.
12. Shear wall proves to be effective in high rise building.

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