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REVIEW PAPER ON ANALYSIS OF EARTHQUAKE RESISTING BUILDING WITH SHEAR WALLS BY USING ETABS SOFTWARE

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Abstract: The present paper shows seismic behaviour of building under the action of earthquake load by performing time history analysis. Nowadays buildings with shear walls are more popular than buildings without shear wall in earthquake prone areas due to its resistance during earthquake. In this study G+13 RCC building is considered for the structural analysis for zone I to zone IV and suitable load combination. The purpose of this study is to find the prime location of shear wall and then investigate the effectiveness of best shear wall for the RCC structure. The structure is analyzed for earthquake in the type of structural system using ETABS software. Wall which is mainly designed to resist lateral forces in its own plane is called shear wall Shear wall are mainly flexural membrane which are specially designed to resist lateral forces which are caused by seismic forces and other forces. Shear wall starts from foundation level and should be continuous throughout of the building.

Keywords: *RCC building, ETABS, Time History Analysis, Shear wall, Seismic analysis.*

I. Introduction

A shear wall is a structural component provided to the multi storied or tall buildings or ordinary buildings in high wind velocity areas. These walls usually begin from the foundation level, along the length and width of buildings. Their thickness can be above 150 mm or below 400 mm in tall buildings and they are like vertical-oriented wide beams that carry the earthquake load towards the foundation.

Shear wall is a concrete wall made to resist lateral forces acting on tall buildings. Shear walls are vertical elements of the horizontal force resisting system. When shear walls are designed and constructed properly, they will have the strength and stiffness to resist the horizontal forces. Properly designed and detailed buildings with shear walls have exhibited very good performance during the past earthquakes. Just like reinforced concrete (RC) beams and columns, RC shear walls also perform much better if designed to be ductile. Overall geometric proportions of the wall, types and amount of reinforcement, and connection with the other elements in the building help in improving the ductility of walls.

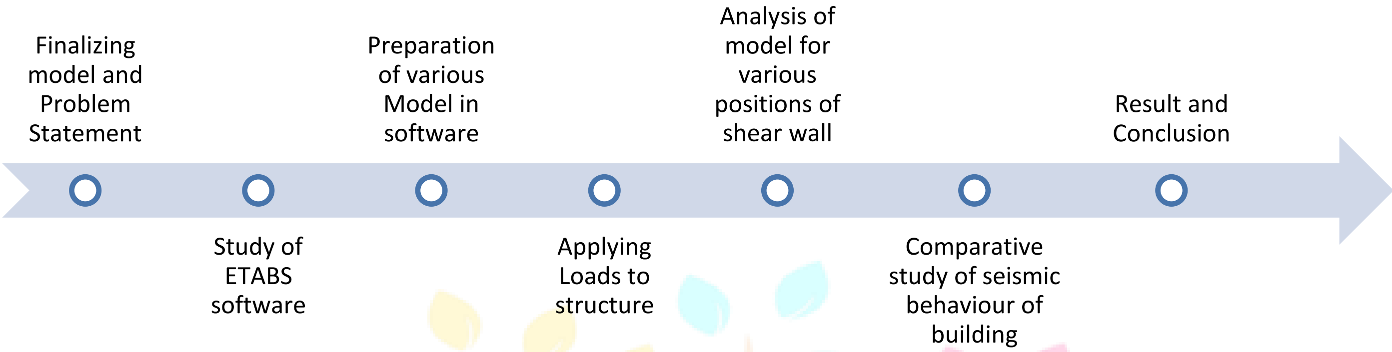
In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. Examples are the reinforced-concrete wall or vertical truss. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure and occupants, create powerful twisting (torsional) forces. These forces can literally tear (shear) a building apart. Reinforcing a frame by attaching or placing a rigid wall inside it maintains the shape of the frame and prevents rotation at the joints. Shear walls are especially important in high-rise buildings subject to lateral wind and seismic forces.

Need of the Shear Wall:
While columns and load-bearing walls keep buildings standing up, carrying the compression load of the structure down to its foundation, the shear wall is what keeps structures from blowing over, resisting the lateral forces of wind and seismic activity. Almost all houses have external shear walls, but internal shear walls are typically found only in larger houses and high-rise buildings subject to lateral winds and seismic forces. The tall the building, the greater the need for internal shear walls and a lateral force resisting system. Most homes and buildings in high-wind and earthquake-prone regions require exterior shear walls. However, larger houses and high-rise structures also need interior shear walls to protect against lateral wind and seismic forces.

II. OBJECTIVES

1) To model and analysed G+13 frame structure having different location of shear wall in the structure using ETABS software.
2) Comparative study of seismic behaviour of building with shear wall and without shear wall by performing nonlinear time history analysis.
3) To find lateral displacement in x and y direction
4) To study the displacement of the building

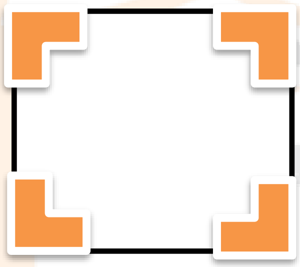
III. METHODOLOGY



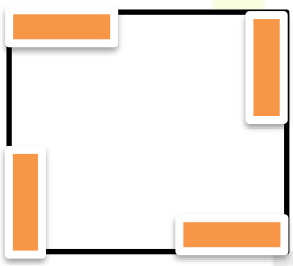
A. Problem Statement

1)Structure: Frame- R.C. Shear wall
2) No. of storey: G +13
3) Type of building: Public building
4) Foundation and soil Type: Isolated footing and medium soil.
5) Unit weight of concrete: 25 kN/m3
6) Column 450×450mm
7) Beam 230×450mm
8) External wall 300mm
9) Slab 150mm
10) Shear wall 230mm
11) Concrete M25 Grade, HYSD Fe415
12) Storey height 3m
13) Modal damping = 0.05 I.
14) Roof slab: Floor finish 1.5 KN/m2
15) Slab: Floor finishes 1.5 KN/m2. Live load 3 KN/m2.
16) Roof beam: Parapet wall load 5.52 KN/m.
17) Beams: Masonry wall load 13.8 KN/m

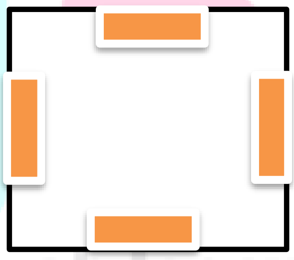
FIG 1. Plan Dimensions



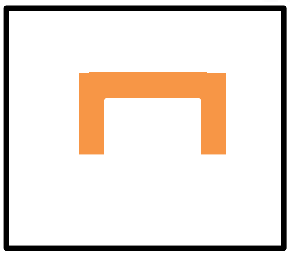
L-SHAPE AT CORNER



I-SHAPE AT CORNER



I-SHAPE AT CENRTE



U-SHAPE AT CENRTE

WITHOUT SHEAR WALLS

The main aim of this paper is to find effective location of shear wall either inner or outer periphery of the building in G+13 RC building Structure. And also, comparative study on Seismic behaviour of building with shear wall and without shear wall. The following analysis are carried out as per IS: 1893- 2016(Part-I) for G+13 storied building models. For this analysis, Seismic zone-

I, zone-II, zone-III and IV is considered. According to IS: 1893-2016 (Part-I) Zone Factor, Z1=0.1,Z2=016,Z3=0.24,Z4=0.36 Importance factor, I=1.5, Response reduction factor, R=5.00, are applied during analysis. Performance is analysis by performing Dynamic Nonlinear Time history analysis Method The analysis is carried out using ETABS software. To find parameters like lateral displacement in x and y direction. in these we have consider that the high-rise building (G+13) for the all four zone to see the effect of the earthquake on the building.

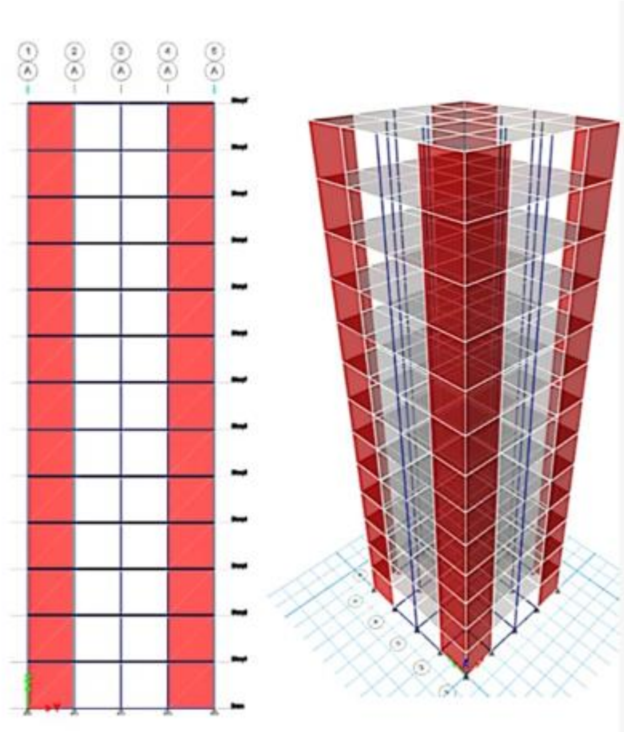
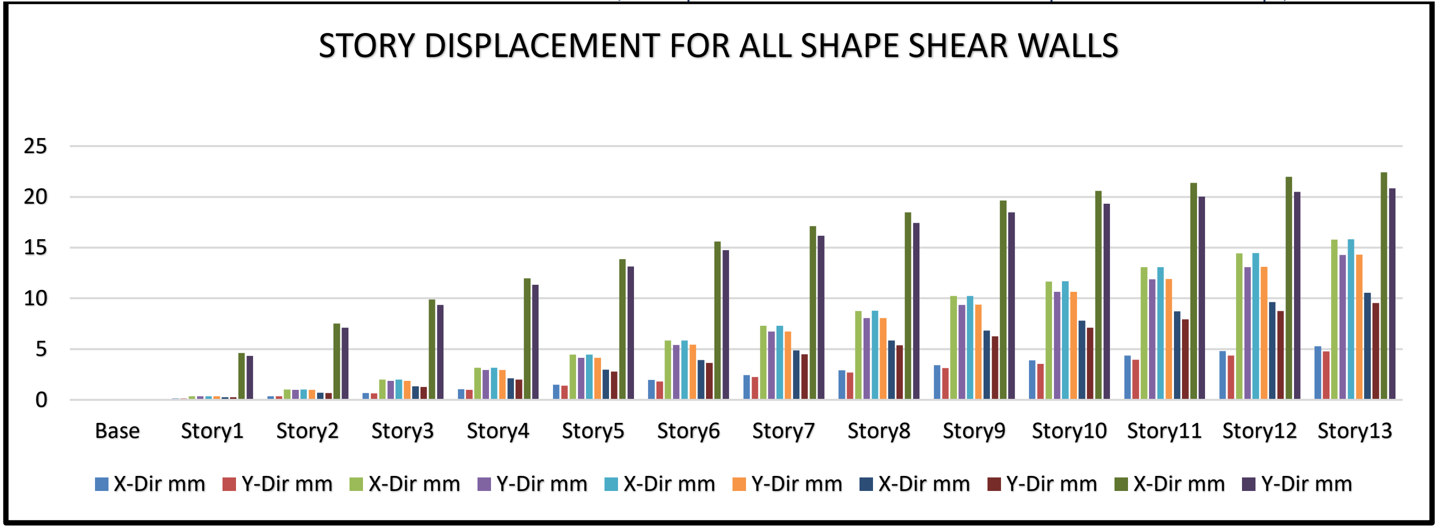


FIG 2. 3D View and Elevation View of High-Rise Building (i.e., G+13)

Story Displacement			L-SHAPE AT CORNER		I-SHAPE AT CORNER		I-SHAPE AT CENRTE		U-SHAPE AT CENRTE		WITHOUT SHEAR WALLS	
Story	**Elevation**	**Location**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**
	m		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
Story13	39	Top	5.273	4.769	15.794	14.28	15.823	14.31	10.562	9.551	22.43	20.825
Story12	36	Top	4.812	4.36	14.437	13.074	14.463	13.1	9.645	8.737	21.989	20.497
Story11	33	Top	4.356	3.962	13.063	11.876	13.085	11.897	8.729	7.938	21.386	20.006
Story10	30	Top	3.888	3.548	11.658	10.633	11.676	10.651	7.789	7.108	20.601	19.332
Story9	27	Top	3.409	3.123	10.22	9.354	10.234	9.369	6.829	6.253	19.627	18.47
Story8	24	Top	2.924	2.688	8.76	8.047	8.772	8.059	5.855	5.381	18.466	17.419
Story7	21	Top	2.437	2.25	7.295	6.728	7.304	6.737	4.877	4.501	17.118	16.179
Story6	18	Top	1.956	1.815	5.85	5.418	5.857	5.425	3.912	3.627	15.586	14.754
Story5	15	Top	1.492	1.393	4.456	4.147	4.46	4.152	2.98	2.779	13.871	13.145
Story4	12	Top	1.059	0.996	3.152	2.952	3.155	2.956	2.11	1.982	11.973	11.35
Story3	9	Top	0.674	0.64	1.989	1.881	1.991	1.883	1.335	1.267	9.877	9.357
Story2	6	Top	0.356	0.344	1.024	0.987	1.025	0.988	0.696	0.671	7.519	7.109
Story1	3	Top	0.133	0.134	0.346	0.347	0.346	0.348	0.245	0.246	4.061	4.332
Base	0	Top	0	0	0	0	0	0	0	0	0	0

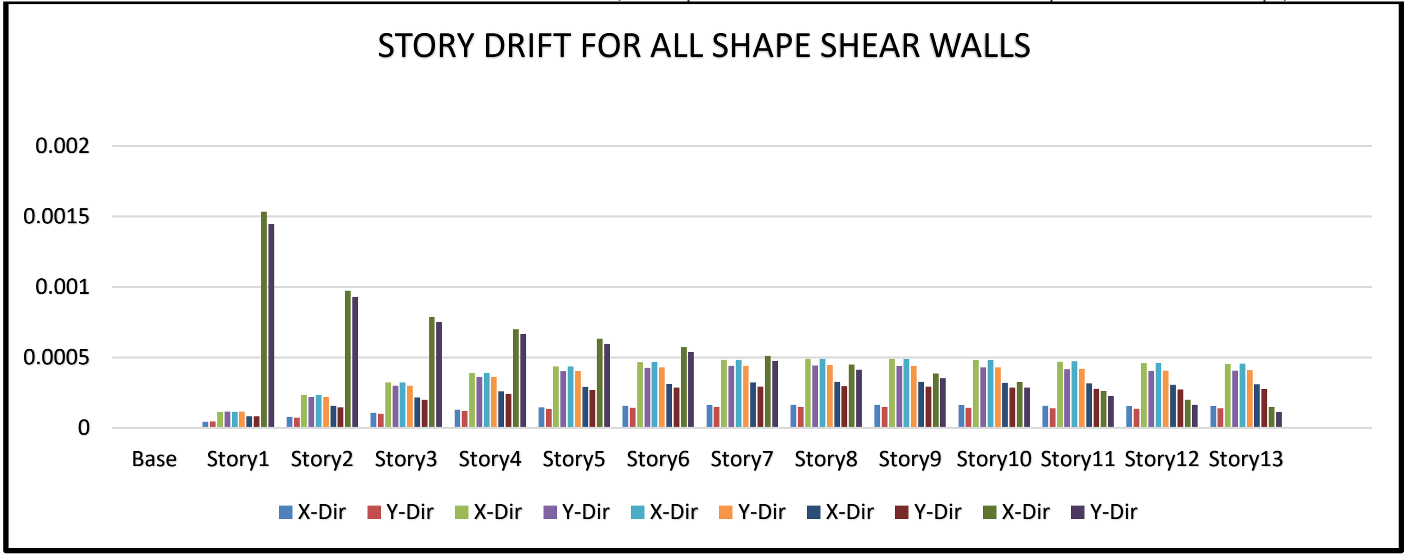
Table-1: -Story Displacement of High-rise Building.



Graph-1: -Story Displacement for High rise Building.

Story Drift			L-SHAPE AT CORNER		I-SHAPE AT CORNER		I-SHAPE AT CENRTE		U-SHAPE AT CENRTE		WITHOUT SHEAR WALLS	
Story	**Elevation**	**Location**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-Dir**	**Y-Dir**
	m											
Story 13	39	Top	0.000155	0.00014	0.000455	0.000407	0.000456	0.000409	0.000308	0.000276	0.00015	0.00011
Story 12	36	Top	0.000154	0.000136	0.000459	0.000405	0.000461	0.000407	0.000307	0.000272	0.0002	0.00016
Story 11	33	Top	0.000157	0.000139	0.00047	0.000416	0.000472	0.000417	0.000315	0.000278	0.00026	0.00023
Story 10	30	Top	0.000161	0.000143	0.000481	0.000428	0.000482	0.000429	0.000321	0.000286	0.00032	0.00029
Story 9	27	Top	0.000163	0.000147	0.000488	0.000438	0.000489	0.000439	0.000326	0.000293	0.00039	0.00035
Story 8	24	Top	0.000164	0.000148	0.00049	0.000443	0.00049	0.000444	0.000327	0.000296	0.00045	0.00041
Story 7	21	Top	0.000162	0.000147	0.000483	0.00044	0.000484	0.000441	0.000323	0.000294	0.00051	0.00048
Story 6	18	Top	0.000156	0.000143	0.000466	0.000427	0.000467	0.000428	0.000312	0.000286	0.00075	0.00054
Story 5	15	Top	0.000146	0.000134	0.000436	0.000402	0.000436	0.000402	0.000291	0.000269	0.00063	0.0006
Story 4	12	Top	0.00013	0.00012	0.000389	0.00036	0.00039	0.000361	0.00026	0.000241	0.0007	0.00066
Story 3	9	Top	0.000108	0.0001	0.000323	0.000299	0.000323	0.000299	0.000216	0.0002	0.00079	0.00075
Story 2	6	Top	0.000078	0.000074	0.000233	0.000218	0.000233	0.000218	0.000156	0.000146	0.00097	0.00093
Story 1	3	Top	0.000044	0.000045	0.000115	0.000116	0.000115	0.000116	0.000082	0.000082	0.00153	0.00144
Base	0	Top	0	0	0	0	0	0	0	0	0	0

Table-2:-Story Drift of High rise Building.



Graph-2: -Story Drift for High rise Building.

IV.CONCLUSION

1) The L-shape shear walls have the less displacement than the other shape of shear walls.
2) Results shows that displacement both in X & Y direction considerably reduced by using shear walls.
3) The maximum story drift in most of the cases produced found at the seventh floor.
4) The presence of shear wall can affect the seismic behaviour of frame structure to a large extent, and the shear wall increases the strength and stiffness of the structure.
5) Structure with shear wall at appropriate location is more important while considering displacement and base shear.

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