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Design of Earthquake Resistant Building in Guntur (G+8)

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ABSTRACT

In the seismic design of structure, reinforced concrete structural wall, or shear wall, acts as a major earthquake resisting member. Structural walls give an able bracing system and offer great potential for lateral load resistance. Shear wall system are one of the most typically used lateral-load resisting systems in high-rise buildings. Shear walls have very high in-plane rigidity and strength, which can be used to at the same time oppose large horizontal loads and support gravity loads, making them pretty helpful in lots of structural engineering applications.

In this study the major focus is to study the response spectrum analysis method of frame structure with and without shear wall. Models are generated with and without shear wall & analysis carry out by Dynamic method using STAAD Pro vi8.

Here the problem taken is on G+8 storied regular building. These buildings have the plan area of 21m x 20m with a storey height 3.050 m each and depth of foundation is 2.593 m. The dynamic analysis has done on computer with the help of STAAD-Pro software using the parameters for the design as per the IS-1893- 2002-Part-1 for the zones- 3 and the post processing result obtained has summarized.

Keywords: seismic design, shear wall, without shear wall , STAAD Pro vi8, IS-1893- 2002-Part-1 for the zones- 3

1. INTRODUCTION

The vision that designing newest buildings to be shaking resistant will cause broad-spectrum extra costs is still amongst the constructional professionals. In a country of modest seismicity adequate seismic resistance of new buildings may be completed at no or no significant additional cost however the spending required to ensure sufficient seismic resistance may depend strongly on the technique selected during the abstract design phase and the relevant design technique. Regarding the theoretical design phase timely relationship between the architect and civil engineering is necessary.

All over world, there is further demand for construction of tall buildings due to growing urbanization and growth population, and earthquakes contain the likely for causing the furthermost damages to those high structures. Reinforced concrete multi-storied or high rise buildings are especially complex to model as structural systems for analysis.

Normally, they are modeled as two-dimensional or three-dimensional frame systems using finite beam element.

The major parameters of the seismic analysis of building are load carrying capability, ductility, firmness, damping and mass. The plan can be separated into two major steps. Primary, a linear analysis is conducted with suitable dimensioning of all structural elements, ensuring the functionality of the structure after small earthquakes, and after that the behavior of structures through strong earthquakes must be controlled by nonlinear method. Dynamic analysis should be performed for symmetrical as well as unsymmetrical building. Due to irregular section of building the main parameter to be considered is torque. The structural engineers perform for both regular as well as irregular buildings.

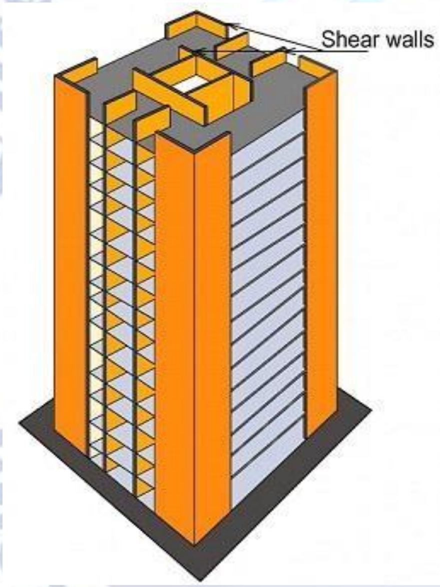


Figure 1: Shear wall

1.1 Seismic zones in India

The Indian subcontinent has a past of shocking earthquakes with 59% of the earth being weak to earthquakes. The Indian plate is driving Asia at a time of roughly 47 mm/year. Intra plate earthquakes as of Himalayan area and lay to rest plate earthquakes of local supply are the key reasons used for seismic design of buildings. As well as due to earthquake Structures into two in addition to movement develop stresses due to inertial force.

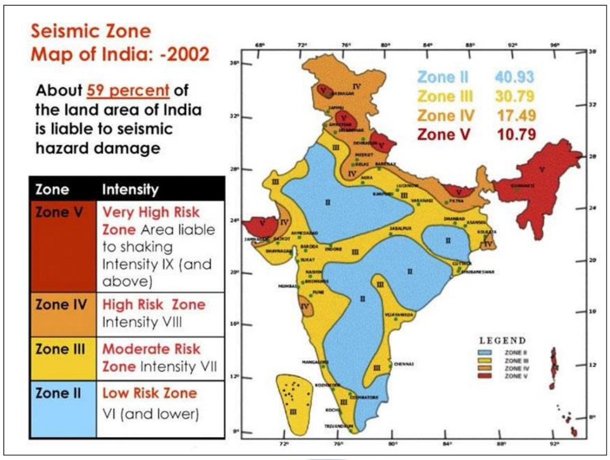


Figure 2: Seismic zonation and intensity map in India

2. RESULTS ON STATIC ANALYSIS

2.1 Preliminary data required for analysis

Table 1: Building data Required

1	No of stories	G+8
2	Floor to floor height	3050mm
3	Column size	900 x 600 mm
4	Beam size	600 x 300 mm
5	Thickness of slab	115 mm
6	Thickness of external wall	230 mm
7	Thickness of internal wall	115 mm
8	Grade of concrete	M-20 & Fe 415 Grade
9	Seismic zone	III
10	Specific weight of RCC	25 Kn/M^3
11	Types of structure	Ordinary RC Framed Structure
12	Location	Sanand

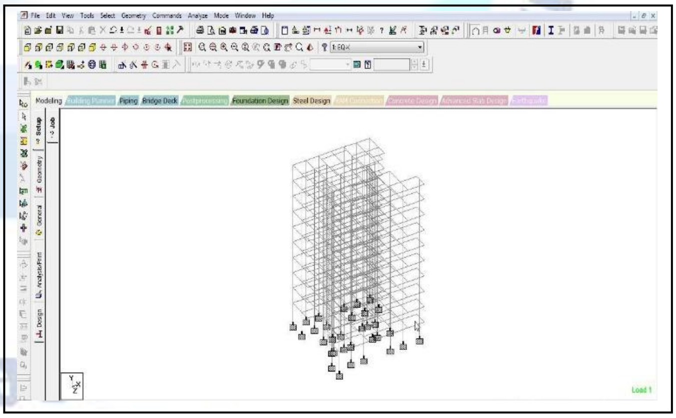


Figure 3: geometry of structures

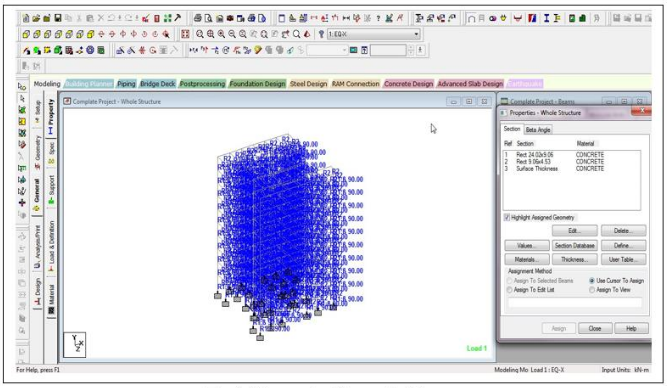


Figure 4: Provide column and beam property or thickness

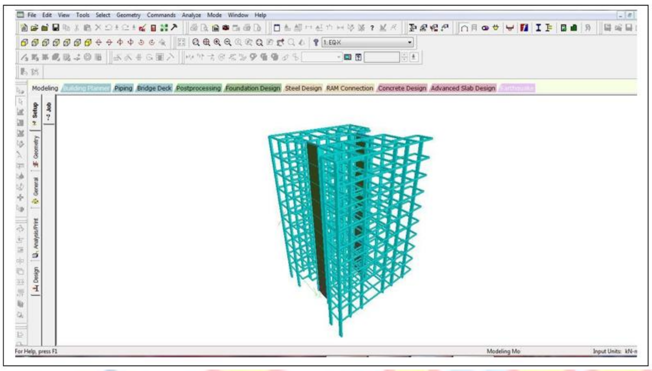


Figure 5: with shear wall

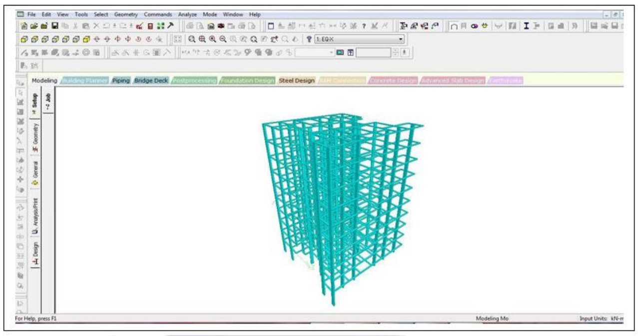


Figure 6: without Shear wall

3. RESULTS ON DYNAMIC ANALYSIS

All actual physical structures, when subjected to loads or displacements, behave dynamically. The further inertia forces, as of Newton's second law, be equal to the mass times the acceleration. If the loads or displacements are applied very gradually then the inertia forces can be ignored and a static load analysis can be justified. Hence, dynamic analysis is a simple addition of static analysis.

In adding, all actual structures potentially have an endless number of displacements. Therefore, the primarily crucial point of a structural analysis is to create a computer model, with a limited number of mass less members and a limited number of joint displacements that will simulate the behavior of the actual structure. The mass of a structural system, which can be exactly estimated, is lumped at the nodes. Also, for linear elastic structures the stiffness properties of the member, by the help of experimental data, can be approximated with a high amount of confidence.

However, the dynamic loading, energy dissipation property and boundary conditions for several structures are complex to estimate. This is always true for the cases of seismic input or wind loads.

In simple language dynamic analysis means a technique to determine response of structure to arbitrary time varying load such as explosion etc.

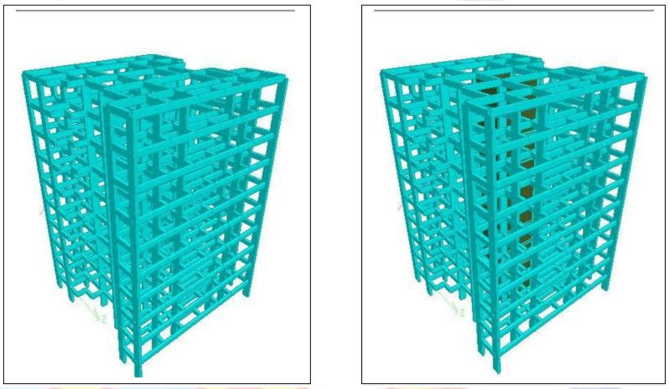


Figure 7: with and without shear wall

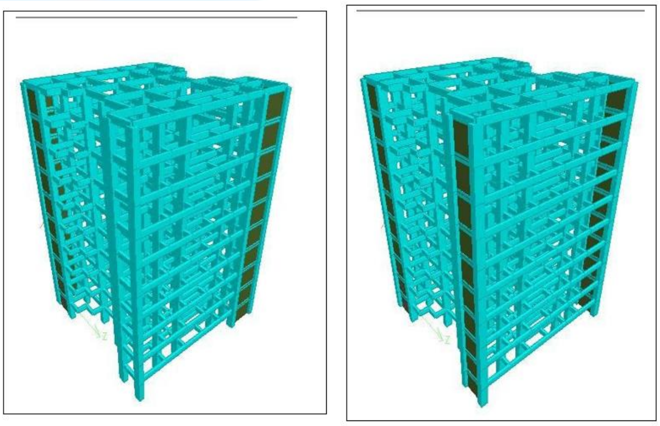


Figure 8: side corner shear wall

Table 2: Storey Drift in X – Direction

Storey No	Base	1	2	3	4	5	6	7	8	9
Model 1	0.1725	0.5464	0.9677	1.4067	1.8477	2.2758	2.6748	3.0268	3.3114	3.5086
Model 2	0.0526	0.1578	0.2805	0.4161	0.5607	0.7098	0.8579	0.9982	1.122	1.2178
Model 3	0.048	0.1718	0.326	0.4912	0.6577	0.8185	0.9675	1.0988	1.2073	1.2918
Model 4	0.0258	0.085	0.1598	0.244	0.3334	0.4246	0.5144	0.5997	0.6772	0.7444
Model 5	0.0761	0.2826	0.5515	0.8462	1.1457	1.4345	1.703	1.9379	2.1325	2.2882

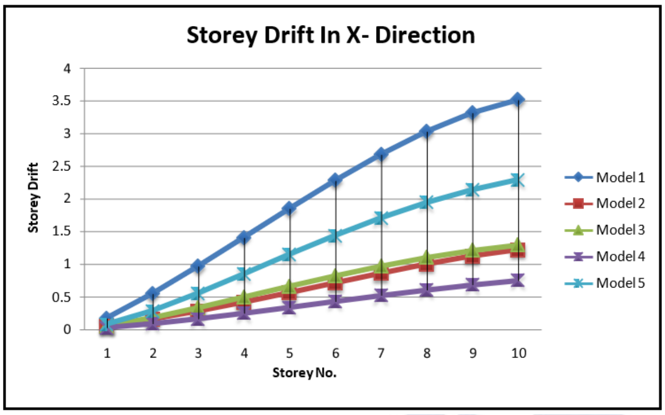


Figure 9: Storey Drift in X – Direction

Table 3: Storey Drift in Z– Direction

Storey No	Base	1	2	3	4	5	6	7	8	9
Model 1	0.0019	0.0074	0.0151	0.0244	0.0348	0.046	0.0577	0.0695	0.0813	0.0927
Model 2	0.0021	0.0078	0.0145	0.0213	0.0279	0.0338	0.0389	0.043	0.0458	0.048
Model 3	0.0005	0.0018	0.0038	0.0064	0.0095	0.0131	0.0171	0.0213	0.0257	0.03
Model 4	0.0019	0.0078	0.0154	0.0239	0.0325	0.0409	0.0485	0.0551	0.0602	0.0636
Model 5	0.0005	0.0022	0.005	0.0088	0.0136	0.0191	0.0253	0.032	0.0391	0.0464

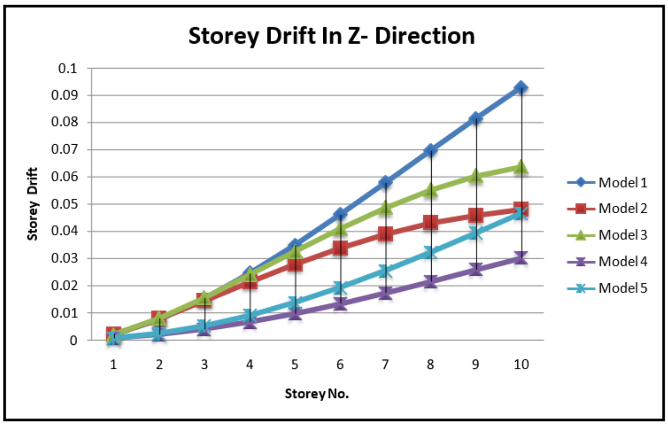


Figure 10: Storey Drift in Z – Direction

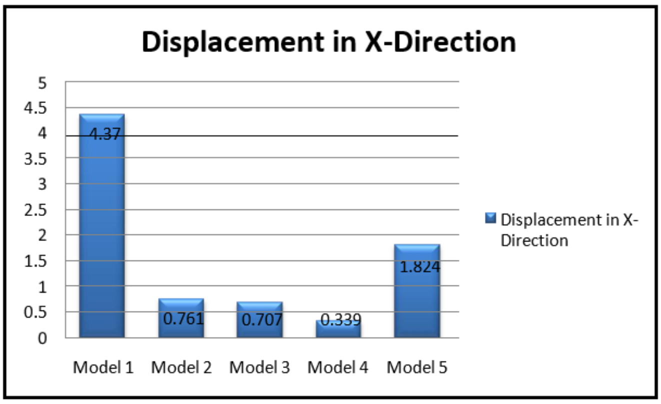
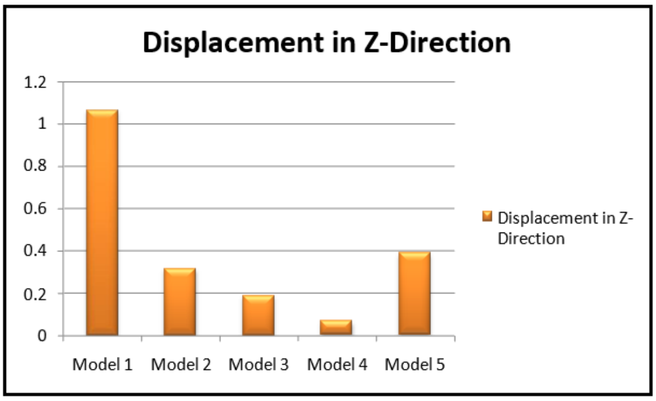


Figure 11: Displacement of structure in X – direction



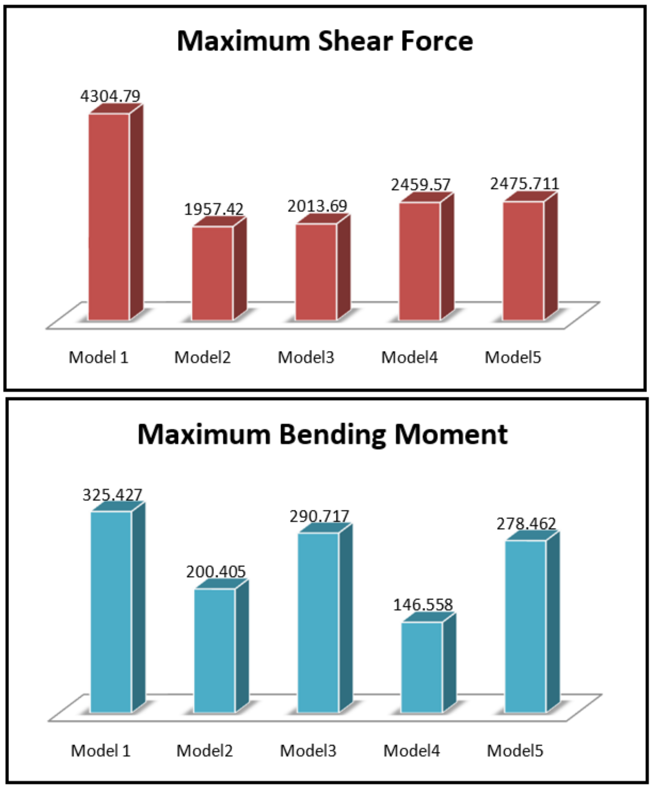


Figure 13: SF and BM

4. CONCLUSIONS

- In this project we carried out Linear static analysis and Dynamic Analysis of (G+8) residential building using STAAD pro Vi8 software to find natural frequency, Shear force ,Bending moment ,Peak storey shear of building under seismic load conditions. Also, we carried out analysis of building with and without shear wall at different location and take result.
- From the results we conclude that presence of shear wall in structure reduces lateral force in building to large extend.
- Shear force and bending moment is less when shear wall is provided at two corners (Model 4) of

structure.

- We are obtained maximum shear force and bending moment at without shear wall.
- Deflection of building or structure of Model -4 (Shear wall at two opposite corner) is very less as compared to other case for G+8 building.
- Peak storey shear is also reduced when shear wall is provided in structure.
- If shear wall is provided on building it's significantly reduce seismic weight of building and also it's reduce node displacement of structure.
- Model no 3 and model no 4 are best place for provide shear wall in G+8 structure
- After analysis of above results it is clear that shear wall system are very effective in resisting lateral forces produced by earthquake. Result's obtain are reliable and are within safe limits.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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