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Study Of Dynamic Effect On Unsymmetrical Building (Rcc & Steel)

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Abstract

The main objective of earthquake engineers is to design and build a structure in such a way that damage to the structure during the earthquake is minimize. The paper gives the idea of dynamic analysis of Steel and RCC building with unsymmetrical configuration.. The analysis is carried on model of G +9 stories of RCC and Steel building with un symmetrical floor plan. The analysis is by carried by using E TABS Software. The parameter such as story drift, story shear and torsion is determined .For dynamic analysis response spectra method or time history method is used .Dynamic analysis should be performed for symmetrical as well as unsymmetrical building .Dynamic analysis is in the form of full nonlinear dynamic time history analysis .If the RCC and Steel building have unsymmetrical configurations, The torsional effect will be produce in both the building and are compared with each other to determine the efficient building under torsion.

Keywords: *Dynamic effect, Finite Element Analysis, Torsion, Seismic Design.*

1. Introduction

The civil structures are primarily based on prescriptive method of building codes. The loads which are acting on this structure are low and resulting in elastic structural behavior. A structure is subjected to the force beyond the limit of elasticity. The structural safety against major earthquake relate to the structural design of building for seismic loading. The loading is different from wind and gravity loading which required much more detail analysis to reach the acceptable elastic range. In dynamic analysis the mathematical model of building are prepared for determining of strength, stiffness, mass and inelastic member properties are assigned. Due to unsymmetrical section of building the major parameter is Torque. The structural engineers perform for both regular as well as irregular buildings. In dynamic analysis the mathematical model of building are develop and determination of strength and stiffness is done. It also shows better response of building under dynamic loading.

2. Problem Statement

The rapid growth of the urban population and consequent pressure on limited space has considerably influenced multi-storey building construction. The increase in demand for space, construction of multi-storey buildings is becoming a necessary part of our living style. These multi-storey buildings can be constructed using various structural systems. The Wind & Earthquake (EQ) engineering should be extended to design of wind & earthquake sensitive tall and unsymmetrical buildings.

3. Methodology of work

1) Extensive literature survey by referring books, technical papers carried out to understand basic concept of topic.
2) Identification of need of research.
3) Formulation of stages in analytical work which is to be carried out.
4) Data collection.
5) Analytical work is to be carried out.
6) Interpretation of results & conclusion.

Dynamic analysis for simple structures can be carried out manually and for high rise buildings the dynamic effect on building can be analysis by using software, if the building is unsymmetrical in nature, the torsoion will produce in building. Torsional failures are seen to occur where the symmetry is not planned in the location of the lateral structural elements as for example providing the lift cores at one end of the building or at one corner of the building or unsymmetrically planned buildings in L shape at the

street corners. Large torsional shears are caused in the building columns causing there torsional shear failures.

`3.1 Analysis of R.C.C. irregular structure using Etabs :

To study dynamic effect on structure, Analysis of G+9 irregular shaped R.C.C. structure carried out in Etab software.

3.1.1 Basic data of the structure :

Ground + 9 storey structure

- Concrete Grade : M20
- Steel Grade : Fe500
- Size of the columns : 450 mm x 450 mm
- Size of the beams : 230 mm x 450 mm
- Floor height : 3 m
- Wall thickness : 150mm

Loads (as per IS 875)

- Live Load : 3 kN/sq.M
- Floor Finished Load : 1.5 kN/ sq.M
- Wall load : 8.25 kN/m
- Parapet wall Load : 3.26 kN/m

Other Parameters

- Earth quake zone factor : 0,16
- Importance factor : 1
- Wind speed : 44 m/sec
- Response reduction factor : 5

3.2 Analysis of Steel irregular structure using Etabs :

To study dynamic effect on structure, Analysis of G+9 irregular shaped steel structure carried out in E-tab software

3.2.1 Basic data of the structure :

Ground + 9 storey structure

- Size of the columns : Built up section of 2 ISMC 425
- Size of the beams : ISMB 250
- Floor height : 3 m
- Wall thickness : 150mm
- **Loads (as per IS 875)**
- Live Load : 3 kN/sq.M
- Floor Finished Load : 1.5 kN/ sq.M
- Wall load : 8.25 kN/m
- Parapet wall Load : 3.26 kN/m

Other Parameters

- Earth quake zone factor : 0,16
- Importance factor : 1
- Wind speed : 44 m/sec
- Response reduction factor : 5

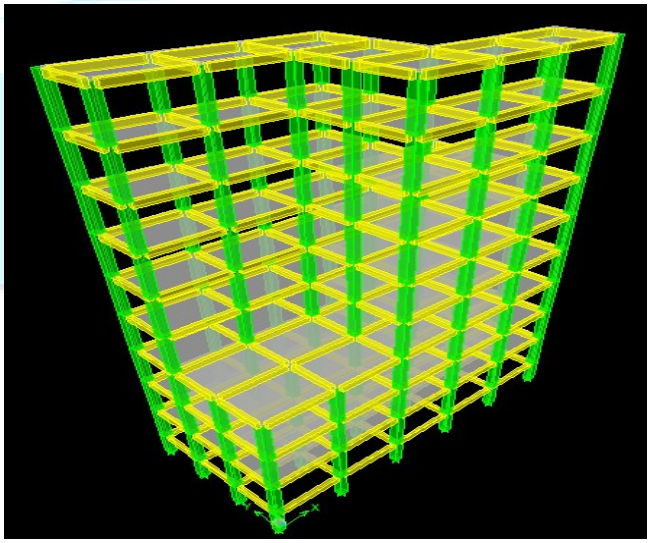
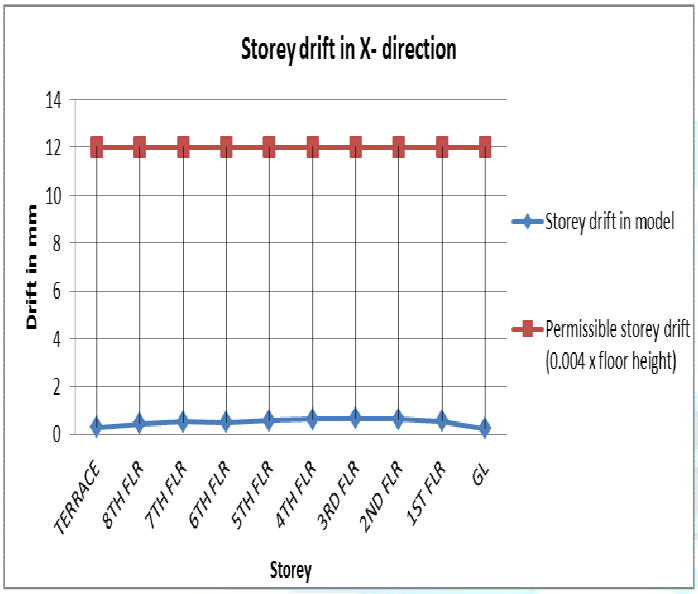


Fig- 3D view of RCC & steel Building.

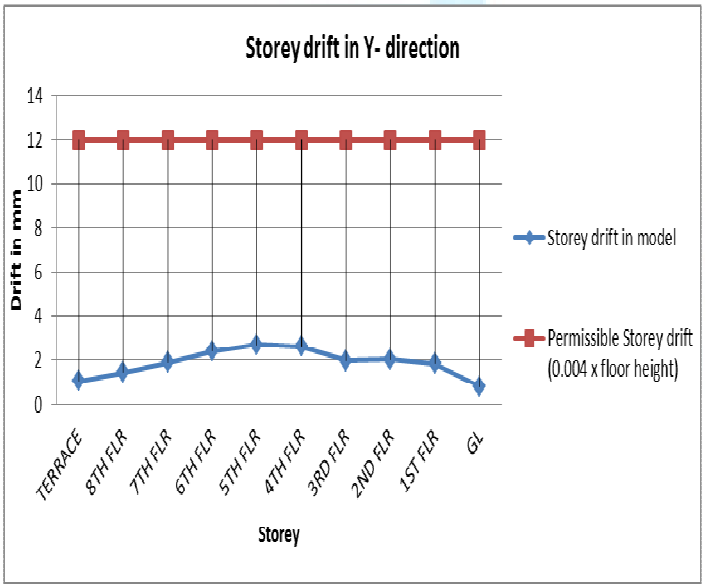
4. Result for RCC building.

4.1 Storey drift :

As per IS 1893(Part 1) : 2002, the storey drift due to lateral load shall not exceed 0.004 times the storey height.

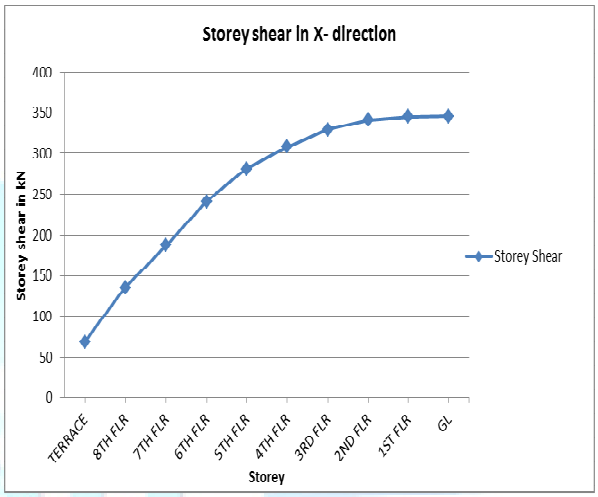


Graph -1: Storey drift in X- direction

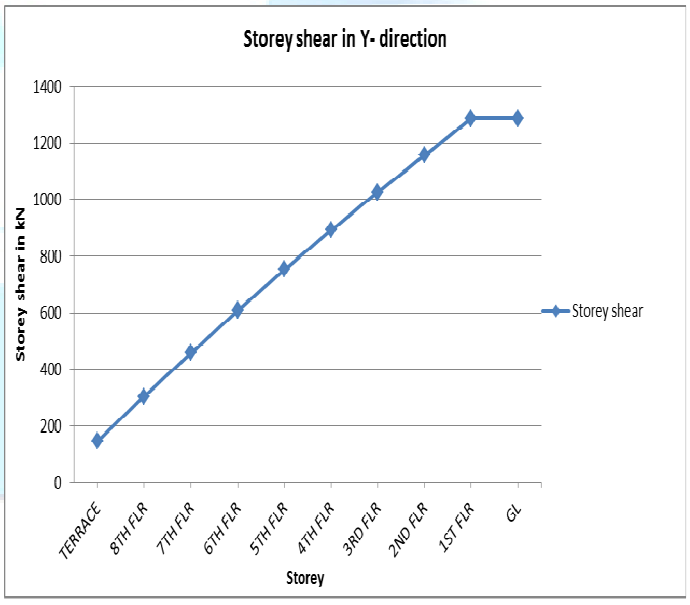


Graph -2: Storey drift in Y- direction

4.2 Storey Shear

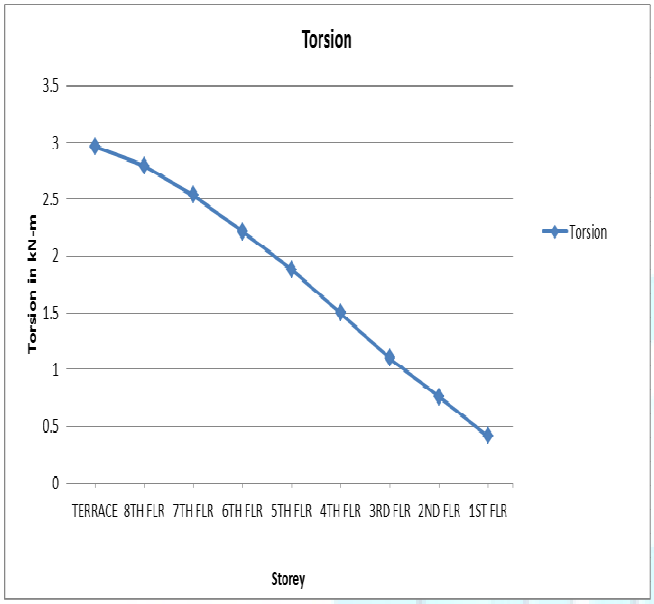


Graph -3: Storey shear in X- direction



Graph -4: Storey shear in Y- direction

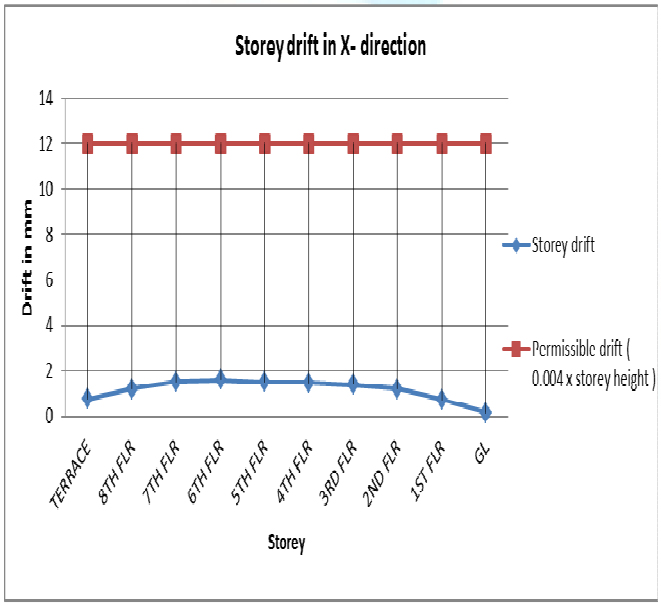
4.3 Torsion



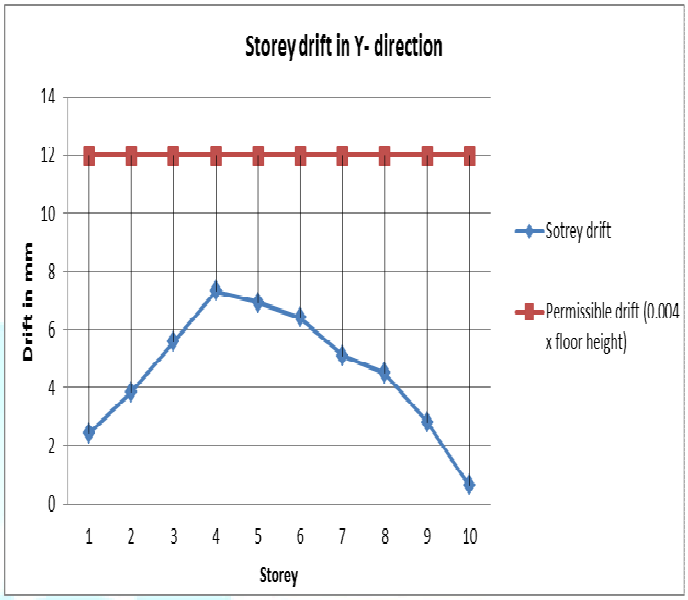
Graph-5: Torsion in 3 mode

5. Results for steel building

5.1 Storey drift :

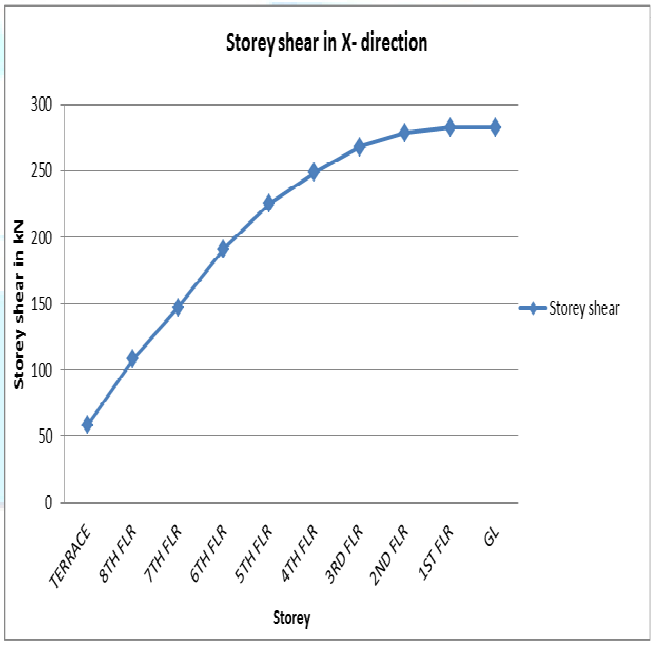


Graph -6: Storey drift in X- direction

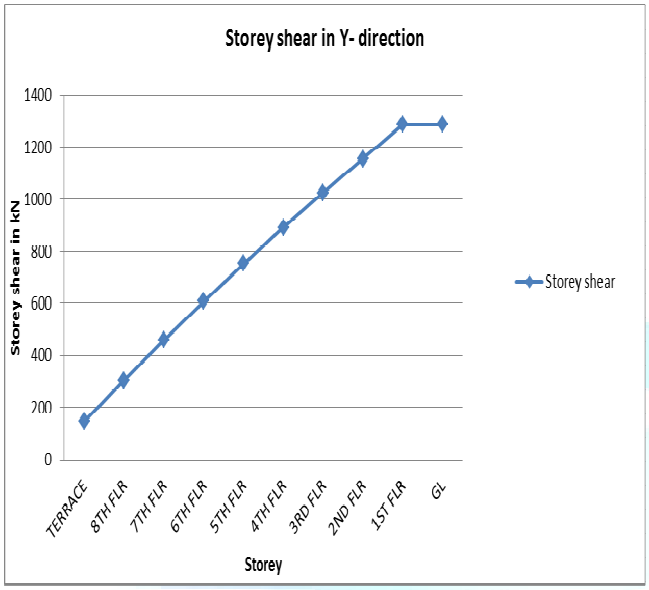


Graph -7: Storey drift in Y- direction

5.2 Storey Shear :

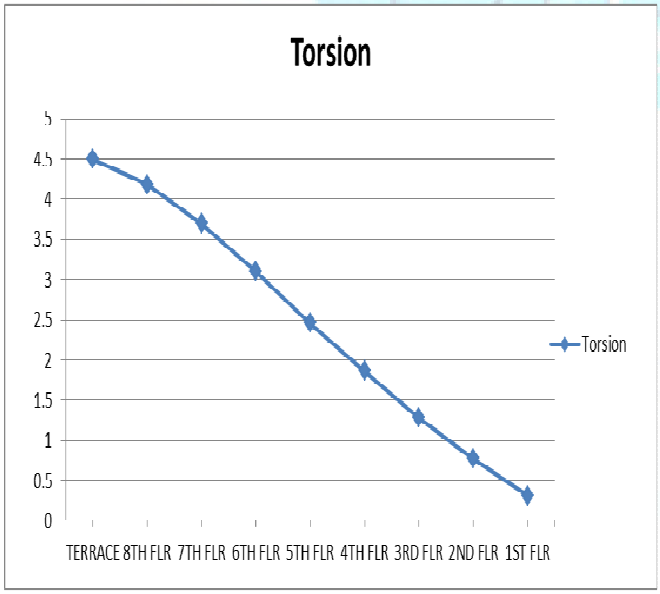


Graph -8: Storey shear in X- direction



Graph -9: Storey shear in Y- direction

5.3 Torsion



Graph -10: Torsion in 3 mode

6. Conclusion

Story Drift

Permissible limit of storey drift 12 mm as per IS1893 (Part1)-2002. By analysis of G+9 storey structure it is found that maximum storey drift of RCC structure is 0.679 mm and 2.702 mm in X and Y direction respectively & steel structure is 1.588 mm and 7.325 mm in X and Y direction respectively. It is with in permissible limit. Hence, Structure is safe for storey drift.

Story Shear

Maximum story shear for RCC structure is found to 345.93 KN and 1286.6 KN in X and Y direction respectively and for steel structure it is found to be 282.8 KN and 1286.6 KN in X and Y direction respectively, thus the steel building appears to more efficient than RCC building.

Torsion

Maximum torsion for RCC building is found to 2.965191 KN-m and for steel building it is found to be 4.493312 KN-m, thus from the above results RCC building appears be more efficient than steel building .

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