Structural Analysis of Steel Structure Building Using STAAD-PRO for Irregularities in Plan Configuration

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Abstract- *The current analytical study was carried out to comprehend the behaviour of steel framed structure in the presence of mass irregularity and floating column. For this, different steel framed Structures were modelled which entails 3 storey. The plan of the building had 5 bays, 7 bays in both the directions i.e. X and Z direction and each bay had a span of 4m x 4m whereas, the height of each floor was taken as 3.25 m. Steel framed building was considered as commercial building, therefore all the loadings i.e. dead loads (as per IS: 875: Part-1) and live loads (as per IS: 875: Part-2) were considered in the same manner. The dynamic seismic analysis had been performed. Which states that every structure shall be designed with dynamic seismic analysis if the structure falls under seismic zone IV. In the end it can be concluded that the steel framed structure is affected with mass irregularity analysis as the forces and moments have been increased.*

Keywords- Steel framed, irregularity structure.

I. INTRODUCTION

In primitive times, the construction work was done at a very small level, just to provide shelter. These small sheltered houses were made up of mud, bamboo sticks, etc. But with the demand for more and more houses, the methods, materials, techniques required for construction change, and the revolution in the field of construction began. Since then many revolutionary structures have been erected with the utmost complex design criteria. Now, the buildings have been categorized into different kinds of structures according to their use, type of material with which the building is constructed, etc. Different complex structures such as bridges, High buildings, water structures have been constructed which has become the magnificent work of the modern world. Multipurpose structures have been constructed where shopping complexes, residential and commercial spaces co-exist.

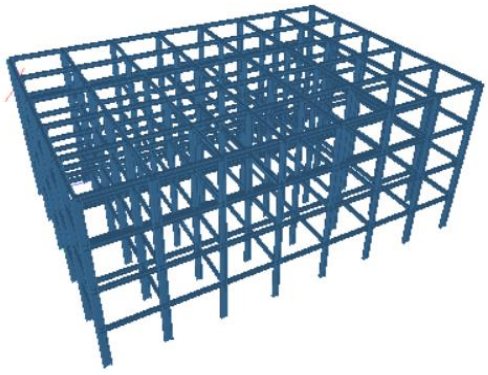
However, irregular structures are those in which arrangement in their mass, strength, stiffness, area covered, etc is not the same along with the height of the structure. Adding to it, a structure with a difference between the center of mass and centre of resistance is also taken as an irregular structure. Most of the time, these modern structures are constructed as irregular structures due to their architectural appearances which is an imperative demand of modern society. There exist different kinds of irregularity in various structures and they are discussed as under:

- Plan Irregularity of the building
- Vertical irregularity of the building

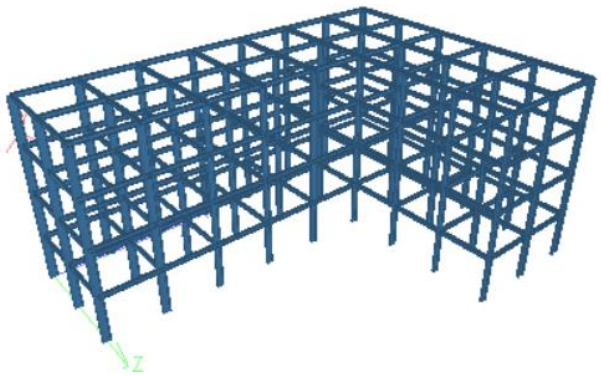
II. METHODOLOGY

An RCC framed structure is basically an assembly of slabs, beams, columns and foundation inter-connected to each other as a unit. The load transfer mechanism in these structures is from slabs to beams, from beams to columns, and then Ultimately from columns to the foundation, which in turn passes the load to the soil. In this structural analysis study, we Have adopted four cases by assuming different shapes for the same structure, as explained below.

1. Rectangular Plan
2. L-shape Plan



(A)RECTANGULAR SHAPE



(B) L SHAPE

III. PARAMETER

Loads acting on the structure are dead load (DL), Live load and Earthquake load (EL).

1. Self weight comprises of the weight of beams, columns and slab of the building.

2. Dead load: Wall load, Parapet load and floor load (IS 875(Part1))

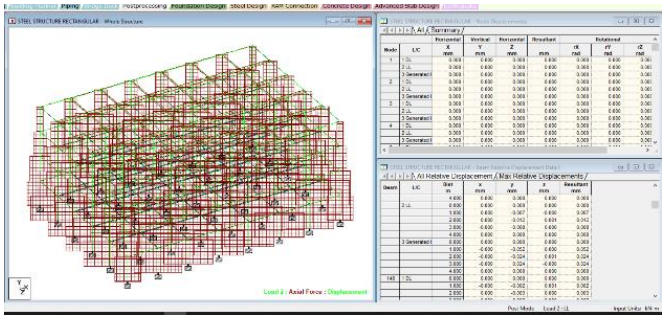
a) Wall load = (unit weight of brick masonry X wall thickness X wall height)

= 20 kN/m3 X 0.230m X 3m

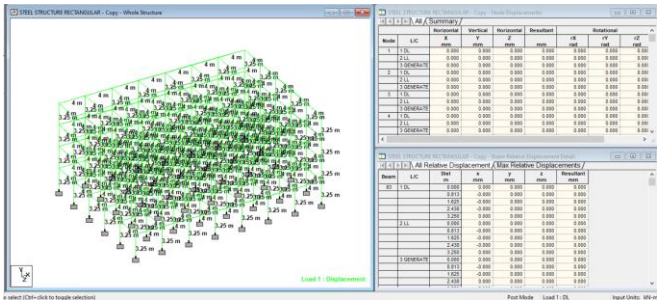
= 13.8 kN/m (acting on the beam)

3. Live load: Floor load: 4kN/m2 and Roof load: 2kN/m2 (IS 875 (Part 2) acting on beams .

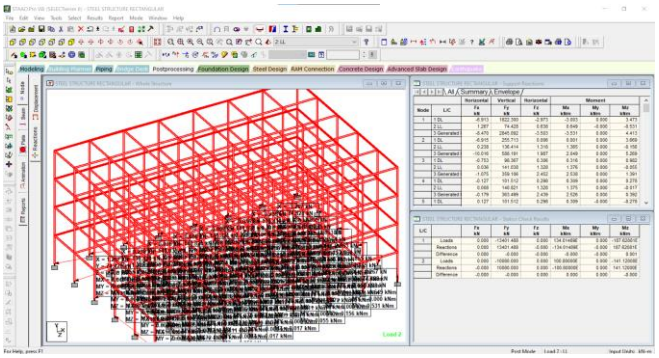
IV. RESULTS



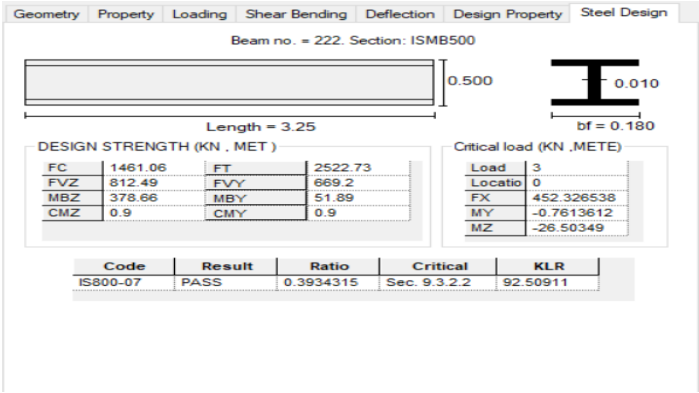
AXIAL FORCE



DISPLACEMENT



SUPPORT REACTION



DESIGN

V. CONCLUSION

The analysis of the multi-storeyed building reflected that the storey overturning moment varies inversely with storey height. Moreover, L-shape, Rectangular-shape type buildings give almost similar response against the overturning moment. Storey drift displacement increased with storey height up to 6th storey reaching to maximum value and then started decreasing. From dynamic analysis, mode shapes are generated and it can be concluded that asymmetrical plans undergo more deformation than symmetrical plans. Asymmetrical plans should be adopted considering into gaps shows that a symmetrical plans undergo more deformation and hence symmetrical plans must be adhered to.

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