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Review of Analysis on Seismic Resistance Building by STAAD Pro

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Abstract: ***The seismic effects on the buildings are very important to calculate to withstand the building against earthquake. In this review paper we have studied the seismic effect on different building of different shape and various other specifications i.e. Zones of earthquake, type of frame, loading and support conditions etc. This study has been done to see the behavior of the building under different circumstances. This paper compares and provides a study of various research work done on seismic analysis of multistory buildings.***

Keywords: Seismic, Shape of building, Loading & Support condition, response spectrum

1. Introduction

Nowadays, due to the dominating effect of earthquake and safety of the human being it is necessary to ensure the safety of the building against earthquake. For this purpose, it becomes necessary to carry out the analysis with accuracy. STAAD Pro provides the facility to analyze the structure accurately with lesser time consumption. In this study different building has considered with different shape, size, Loading conditions, and support conditions. Also, the effect of response spectrum analysis on the building has been studied and the behavior of the building analyzes in terms of deflection, bending moment, shear force, axial forces etc.

2. Response Spectrum Analysis

The performance of structure and equipment's in earthquake can be easily analyzed by response spectra. Response spectrum method give an ease to perform equivalent lateral load analysis. The response spectrum method of analysis enables us in clear understanding of various modes of vibrations. It is also a reliable method of seismic analysis. The response spectrum method is first incorporated by the U.S. building codes around 1950. Decades by decades response spectrum method playing a very important role in design of structures under seismic action.

3. Literature Survey

In this review paper the performance of building of different geometrical shape have been studied. Some of the researchers analyzed the building with different geometrical plan and compared the response of the structure under different condition whereas some of the researchers studied and analyzed the vertical irregular building for seismic load.

Veena S Ravi, Sreedevi Lekshmi analyzed 7 models of G+11 storey. The objective of the research was to compare the different building plans response under the seismic action by response spectrum analysis. This analysis had been done by STAAD Pro software. Regular square plan, E shape, H Shape, T shape, L shape, plus shape and C shape plan had taken for the analysis of the structure by them. The parameters for analysis had taken from IS 1893- 2002-Part-1. In this analysis sever earthquake zone V and also earthquake zone I had taken for analysis. The results of this analysis had evaluated and compared in terms of lateral shear, displacement, time period etc. From the study of this research it is clearly seen that the base shear in L-shape plan building is least as compare to all other shape building and the maximum base shear is found within the regular square shape building.

Table 1: Design Base Shear for zone II

Shape	Base shear (KN)
Plus	668.50
Regular Square	937.07
E	816.42
C	795.58
T	680.71
H	664.63
L	593.05

It is clearly seen that the maximum value of the base shear is for regular square building and least value of base shear is in L shape plan building.

Time period

Table 2: Time Period in Sec.

Shape	*Time Period (Sec.)*
Plus	3.92657
Regular Square	3.74447
E	3.62401
C	3.79886
T	3.59799
H	3.39656
L	3.57487

Base Shear of different shape building zone V

Table 3: Design Base Shear for zone V

Shape	*Base shear (KN)*
Plus	2478.60
Regular Square	3373.44
E	2939.11
C	2864.11
T	2450.54
H	2392.67
L	2134.98

S. Sindhu Nachiar, S. Prabhu Booshan and S. Anand studied the behavior and response of the structure for vertically irregular building under seismic condition by response spectrum method of analysis. In this research they modeled and analyzed the building structure using Etabs 2015. Vertical irregularity like stiffness, mass and geometry analyzed at different height of 10 storey, 15 storey and 20 storey.

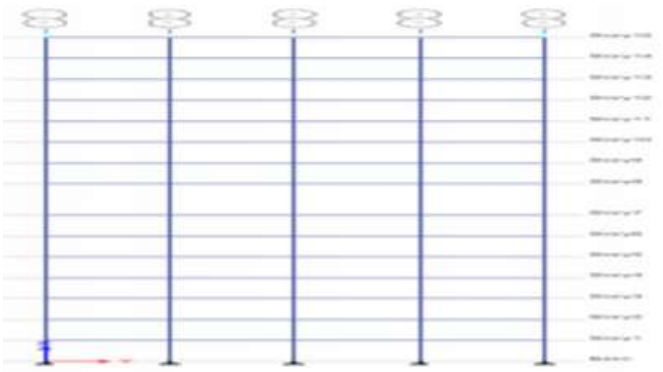

Figure 1: Structure with stiffness irregularity

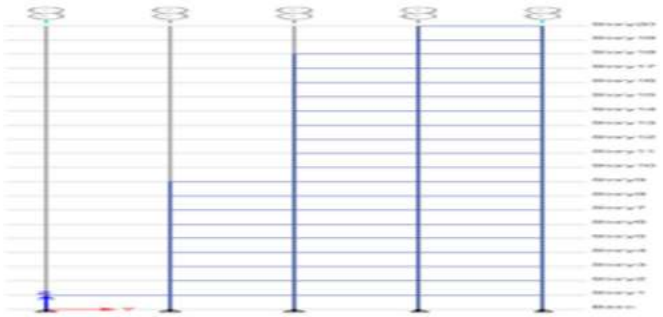

Figure 2: Structure with setback

Parameters considered for Analysis

Table 4: Parameters

Dead load (wall)	15.732 kN/m
Dead load (parapet wall)	3.96 kN/m
Dead load (floor pressure)	5.75 kN/m^2
Live load	3 kN/m^2
Live load (roof)	1.5 kN/m^2
Floors finish	2 kN/m^2
Density of RCC	24 kN/m^3
Grade of concrete	M30
Grade of steel	Fe 415
Seismic zone	3 (moderate)
Type of soil	Medium soil
Zone factor	0.16
Damping ratio	5%
Importance factor	1

Description of the model

Table 5: Description of Model

DESCRIPTION	10 – STOREY	15 - STOREY	20 – STOREY
Area	12m x 24m	16m x 28m	20m x 32m
Ht. of each storey	3m	3m	3m
Beam	350mm x 400mm	450mm x 500mm	550mm x 600mm
Column	400mm x 400mm	500mm x 500mm	550mm x 600mm
Slab thickness	150mm	175mm	200mm
Thickness of wall	230mm	230mm	230mm
Levels chosen for placing irregularities	2nd, 5th and 9th floor	2nd, 8th and 14th floor	2nd, 10th and 19th floor

Rucha S. Banginwar, M. R. Vyawahare, P. O. Modani analyzed various models of different geometrical plan and also vertically irregular shape building structure. They considered three different plans for analysis. This analysis had been done by response spectrum method and the structure is analyzed by Etabs software. Total 8 storey taken for analysis with the following details.

Building name B1, B2, B3.

1) All the three buildings are having approximately equal area, spacing of the frame =3-3.2m, spacing of columns =10-11m.
2) Height of building =25.1m
3) Size of beams=300*750mm
4) Size of columns=300*600mm
5) Seismic zone factor=0.36
6) Type of soil =medium
7) Nature of three buildings is explained as follows-

Table 6: Nature of building

Type of building	Nature of building
B1	Regular Profile
B2	Moderately Irregular
B3	Severely Irregular

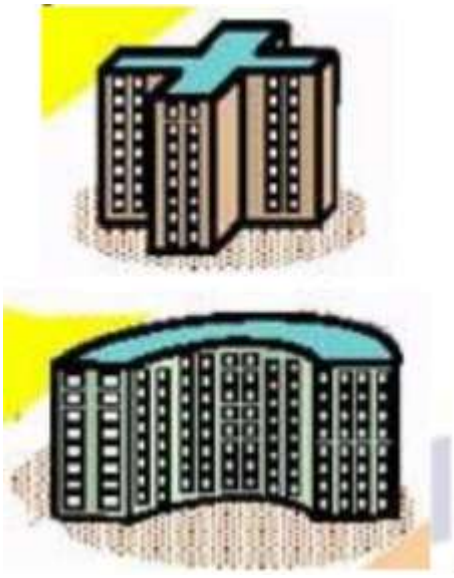

Figure 3: Strongly Irregular Building

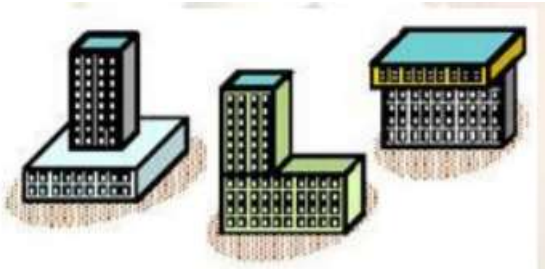

Figure 4: Unsymmetrical Building

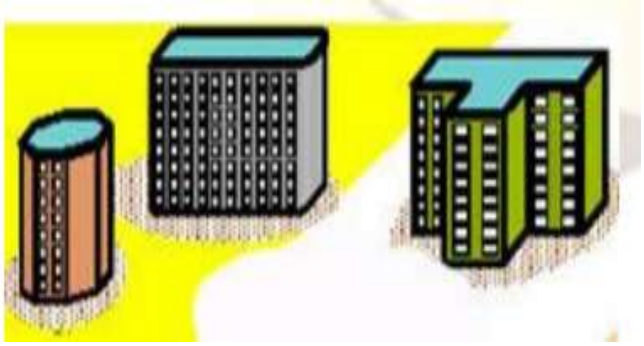

Figure 5: Symmetrical Building

4. Conclusion

A study on the behavior of the building under seismic load using different geometrical shape with response spectrum analysis has been done. Various seismic analysis and studies on different geometrical condition of the building has done by various researchers. Followings are the conclusions made in the study.

- From the study on different building of different shape it has been observed that the displacement is increasing with the increasing height of the buildings.
- Response spectrum method enables us to analyze the structure for different vibration condition.
- It is also observed in the study that base shear in irregular shape building is less than the regular shape in response spectrum analysis.
- The study shows that the value of Base shear and displacement in static analysis are higher than the response spectrum analysis.
- In vertically irregular building due to the irregularity in stiffness the inter storey drift is higher than the regular. If the vertical irregularity due to stiffness is there than the storey drift will increase in conventional structure.
- Joint displacement increases due to the irregularity due to extra mass.
- Due to the mass irregularity the displacement also gets higher.
- It is summarized in the study of vertical irregularity of the building that the structure is less stable to the seismic force.
- It is also observed from the study that if the level of irregularity increases beyond the certain limits then torsion is developed in the building.
- It is also observed in the study that if the irregularity increases beyond the certain limits the displacement in the building also gets increases.

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