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ANALYSIS OF G+10 FLOOR BUILDINGS OF DIFFERENT GEOMETRICAL PLAN BY RESPONSE SPECTRUM METHOD USING STAAD PRO

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ABSTRACT

The objective of this research is to analyze the seismic effect of the building of geometrical plan configurations and compare the analysis on various parameters i.e. axial forces, displacement, base shear, bending moment, shear force, support reaction etc. For this analysis response spectrum method has been selected and it is analyzed by using STAAD Pro software. In this analysis a regular square shape building in plan is analyzed and the same is compared with H-shape plan building. Also, all the data being used for this analysis are same i.e. size of column, beam, height of floors, etc. The results of this analysis have been compared using graphs and by graphical representation of displacement of both the buildings, axial forces, stress distribution through the height of the building etc. This analysis has been carried out to observe the effect on the stability of the building under seismic analysis and to make an ease in the selection of the shape of the building in the seismic zone.

KEYWORDS: Response spectrum, Staad pro, analysis.

1. INTRODUCTION

The structural response of the structure depends on the shape of the building in seismic zone. Building with regular shape behaves differently with irregular shape. Two different models of different plans have prepared and compared. One building plan of regular square shape has selected and another plan of H-shape have selected. This analysis has been carried out by response spectrum method and STAAD Pro software is used to obtain the results. All the parameters of the analysis are taken same i.e. height of the building, size of the columns and beams etc. also same seismic zone IV selected for the analysis. In this analysis the special moment resisting frame is selected instead of ordinary moment resisting frame in both the models. Similarly, the medium soil is selected in both the models for analysis.

2. SEISMIC ANALYSIS PARAMETERS

As shown below in this analysis value for zone IV is taken as 0.24, response spectrum factor is 5, importance factor is 1, rock and soil site factor is 2, type of structure is 1, damping ration is 0.05, period in x-direction and y-direction is selected.

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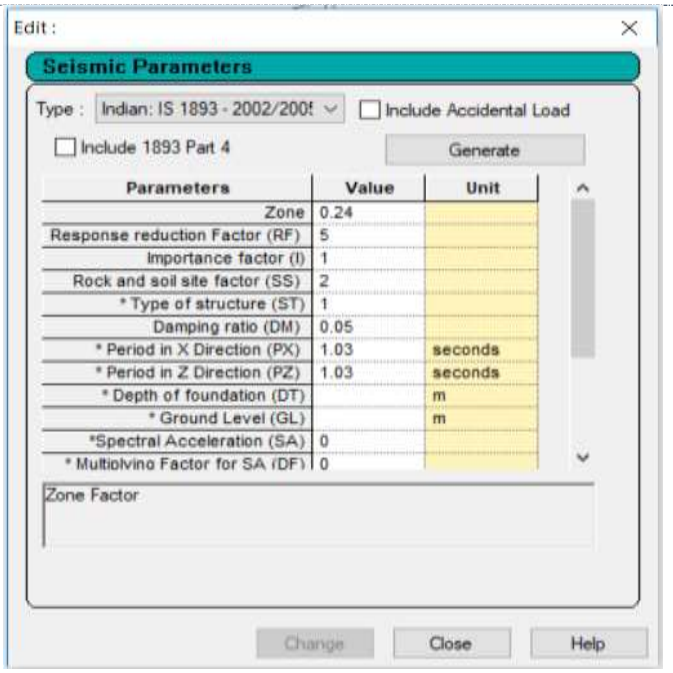
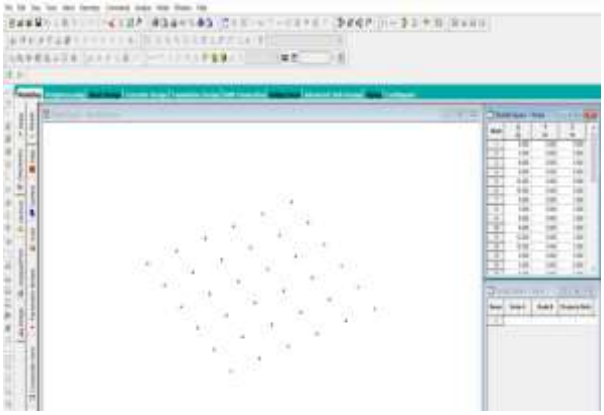


Fig.1 Seismic Parameters

3. ANALYSIS

The analysis is divided in to various parts including modeling of structure, defining the properties of the members, assigning the properties to the members, defining the support conditions to the structure. It also includes defining and assigning the load to the structure. Thereafter analyzed the structure in STAAD Pro software and obtained the results in terms of axial load, displacement, base shear, peak shear, bending moment, shear force, support reaction etc.

3.1 Square Model Details



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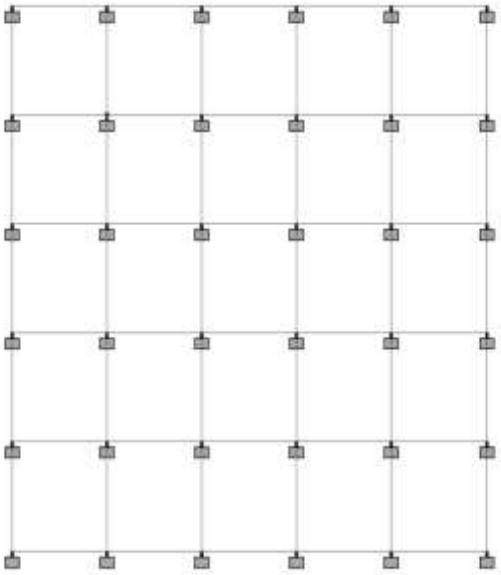

Fig.3 Square building Plan

3.2 H-shape building plan details

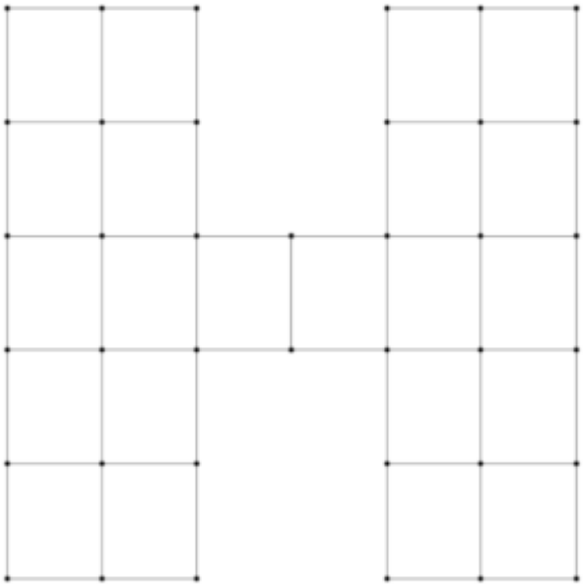

Fig.4 H-shape building plan

4. ASSIGNING OF SIZE OF BEAMS AND COLUMNS

The size of beam and columns are first provided for the analysis. The rectangular beam of size 400 x 400 mm is selected and column of 550 x 600 mm is selected for the analysis of the structure. The fig clearly shows that the direction ZD represents the width of the beam and YD represents the depth of the beam.

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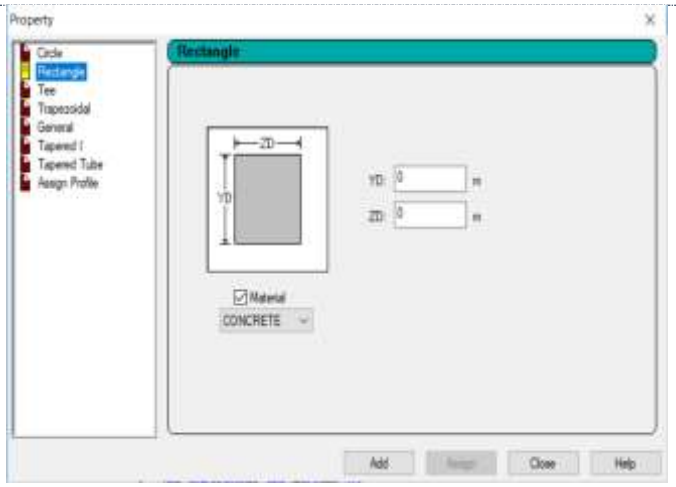

Fig.5 Beam and column size

5. LOADS

Total three forces applied first:
Self-weight of the structure, member load and floor load.

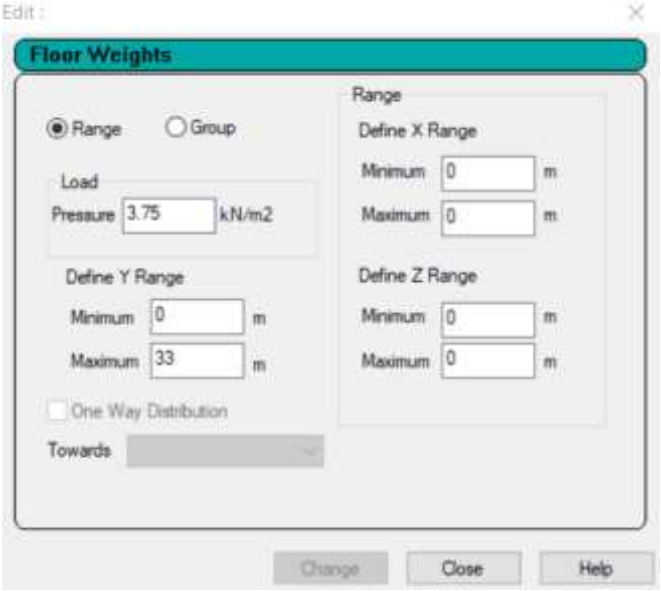

Fig.6 Floor load

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5.1 Seismic load

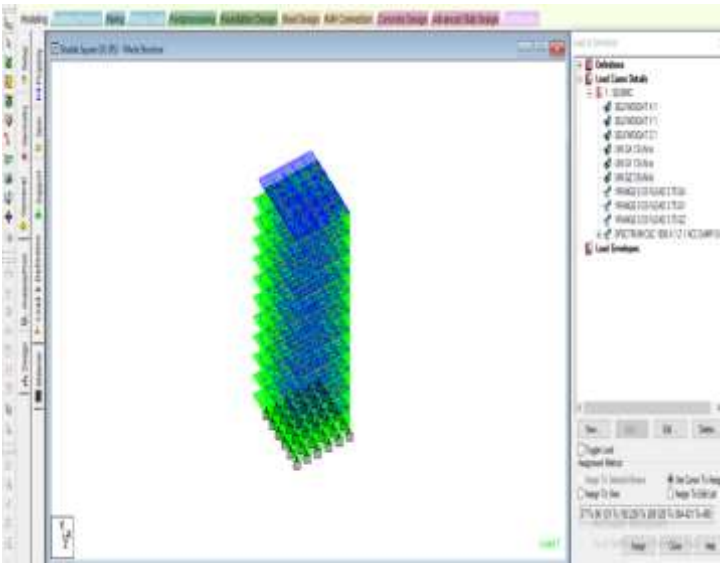

Fig 7

5.2 Response spectrum

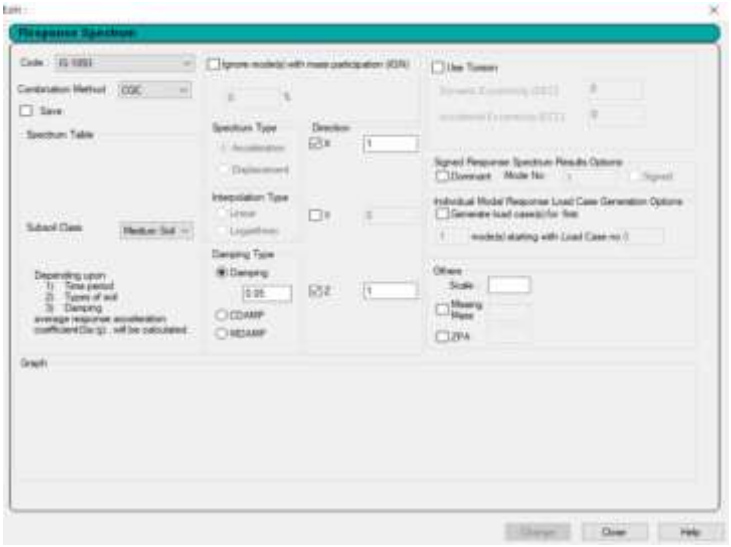

Fig. 8 Response spectrum

6. RESULTS

The analysis on regular square shape building and H-shape building has been done by response spectrum method using STAAD Pro. This analysis has compared on some parameters i.e. base shear, displacements, support reactions, bending moment, shear force, etc.
Followings are the comparisons of the results:

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6.1 Comparison of Base Shear of Square shape and H-shape building

Table 1 Comparison of base shear

STOREY	SQUARE SHAPE MAX BASE SHEAR (KN)	H-SHAPE MAX BASE SHEAR (KN)
11	7345.07	6844.33
10	14463.38	13630.23
09	20264.67	19243.93
08	24667.27	23624.92
07	27979.19	27038.17
06	30772.44	29954.19
05	33557.90	32772.60
04	36449.05	35559.26
03	39099.71	38012.68
02	40965.25	39686.47
01	41704.81	40330.37
Base	41704.81	40330.37

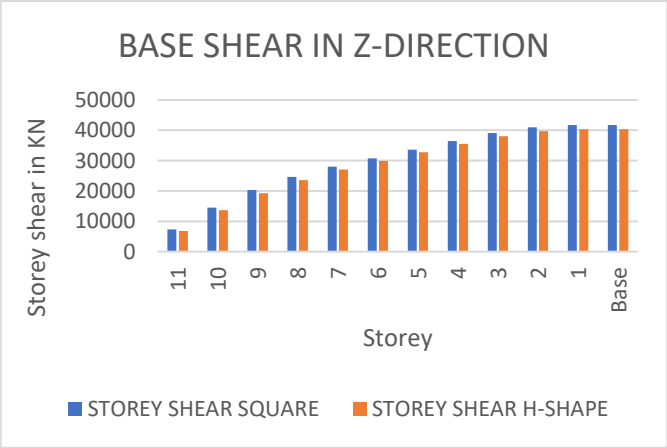

Fig.9 Storey shear

6.2 Displacement

Table 2 Comparison of maximum Displacement

Maximum Relative Displacement of Beams	
Square Shape Building	**H-Shape Building**
10.695	9.563

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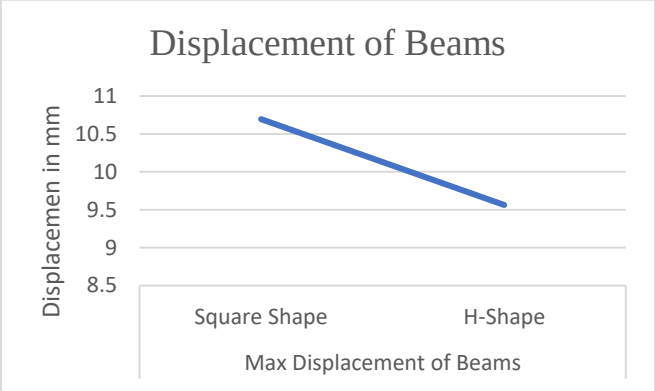

Fig.10 Maximum displacement comparison

6.3 Support Reactions

Table 3 Comparison of maximum support reactions

Maximum Vertical Support Reactions (KN)	
Square Shape Building	**H-Shape Building**
16359.843	16531.070

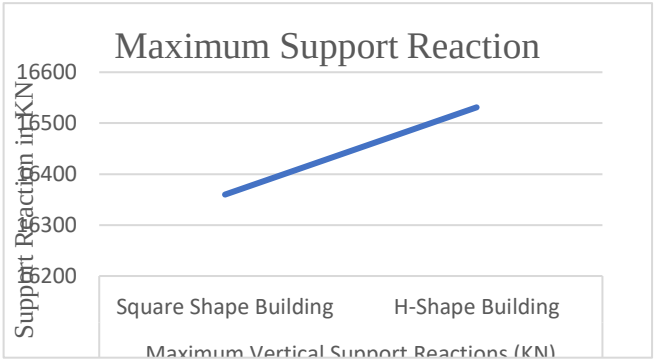

Fig.11 Maximum Support Reaction Comparison

6.4 Bending Moment

Table 4 Maximum Bending Moment Comparison

Maximum Bending Moment (KN-M)	
Square Shape Building	**H-Shape Building**
3164	2888

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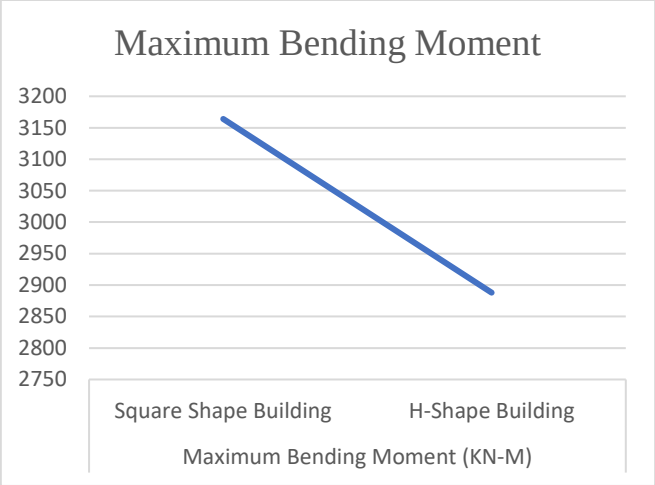

Fig.12 Maximum Bending Moment Comparison

6.5 Shear Force

Table 5 Comparison of shear force

Maximum Shear Force (KN)	
Square Shape Building	**H-Shape Building**
1336	1310

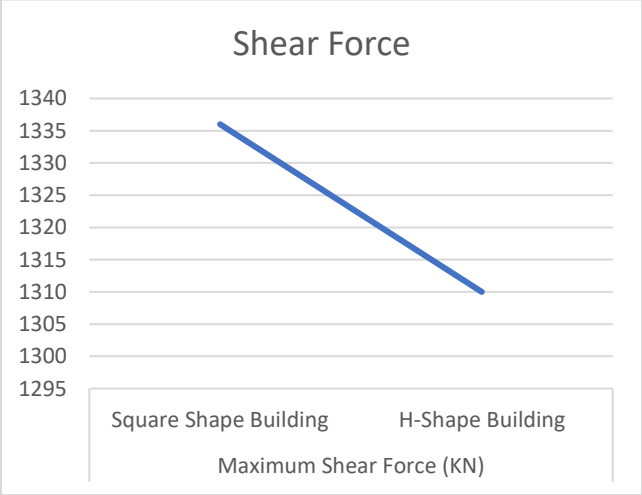

Fig.13 Maximum Shear force Comparison

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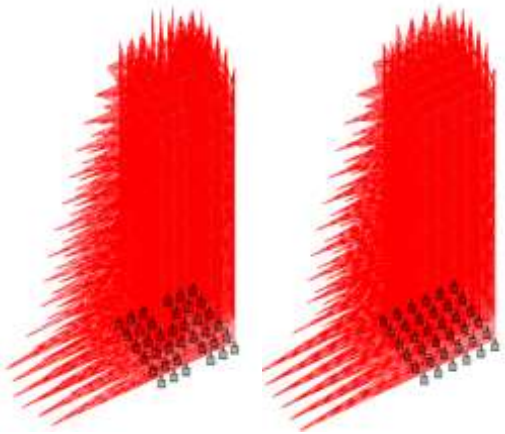

Fig14. Shear force graphical representation

7. CONCLUSION

An analysis on the behavior of the building under seismic load using different geometrical shape i.e. regular square shape and H-shape with response spectrum analysis has been done. Analysis of both square shapes building and H-shape building have compared in terms of Base shear, Reactions, Displacement, Bending Moment, Shear Force etc.

Followings are the conclusions:

- The seismic analysis on square shape building and H-shape building is done and it is found that the H-shape building is more stable and economical as compared to the square shape building.
- From the analysis on square and H-shape building of different shape it has been observed that the displacement is increased with the increasing height of the buildings. It is also found in the analysis that maximum displacement in square shape building is more than the H-shape building.
- Response spectrum method enables us to analyze the structure for different vibration condition.
- It is also observed in the analysis that maximum base shear in H-shape building is less than the regular shape in response spectrum analysis.

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