Comparative Study on Dynamic Analysis of a Multi-Storey Frame in Zone III and Zone V

Mohommad Abdul Salam, Nirbhay Thakur, Nitish Kumar Sharma

Abstract: Former incidence of earthquake consequences in breakdown of building which were not predominantly contrived to be earthquake resistant. In interpretation of this, the structure has to be premeditated with seismic confrontation. An earthquake is the outcome of an abrupt release of dynamism in the Earth's crust that crafts seismic waves. It is also known as a quake, tremor or temblor. An earthquake is instigated by a sudden slip on a fault.

Index Terms: Dynamic Analysis, Response Spectrum Method, Zone III and V, Shapes H and T.

I. INTRODUCTION

Due to indecorous design of the structure without seismic confrontation many structures have distorted and lives have gone. Various looks at like Base Isolation, Damping Devices, shear divider and Bracing Systems have been surrendered out to defeat this need so as to secure the structure and lives which does not improve the execution of the structure. Among these techniques, shear divider and bracings has been decided for this investigation. Shear dividers ought to be situated on each dimension of the structure including the creep space. To frame a usable box structure, equivalent length shear dividers ought to be situated symmetrically on each of the four outside dividers of the structure.

II. RESEARCH GAP

In the past studies specified by various authors, shear wall at different locations and different bracings were utilized in frames so as to study their seismic effects.

Now, in the present study, it has been decided to model frames with combinations of shear wall and bracings at different locations and in different zones. Linear dynamic behavior of moment resisting frames was studied with the different combinations, so as a result to make a comparative relation and to have a precise position of shear wall and steel bracings. In the present study, research gap is covered with the efforts made to cover the wide range of comparative study cases of combination of bracings and steel bracings.

III. OBJECTIVES OF THE STUDY

I. To compare symmetrical and unsymmetrical building frames subjected to seismic excitations.

II. To study the inter story drift, base shear and displacement at nodes for H-type and T-type frames consisting of bracings.

III. To study the inter story drift, base shear and displacement at nodes for H-type and T-type frames consisting of shear wall at different locations.

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IV. RESEARCH METHODOLOGY

In the current study, importance was through on the analysis of H-type and T-type frames using Response Spectrum Method. A (G+13) building was modeled for the study. Different building models were prepared consisting of shear wall and composite bracings at different locations so as to make a comparative study for precise solutions. By doing so, effective location of shear wall and bracing can be analyzed. The parameters on which the comparative study was made are: Base shear, Story Drift and Displacement at nodes.

Table 1: Specifications of the building

Specifications	Data
Story Height	3.0m
Bays along X direction	3
Bays along Z direction	3
Bay Length along X direction	5m
Bay Length along Z direction	5m
Grade of Concrete	M 40
Columns	0.45m x 0.45m
Longitudinal Beams	0.45m x 0.25m
Transverse Beams	0.35m x 0.25m
Slab Thickness	0.15m
Unit Weight of Concrete	25 kN/m^3
L.L.	4.0 kN/m^3
Building Type	General Building (I=1)
Type of soil	Medium Soil
Response Reduction factor	5
Damping ratio	5%
Bracing	ISHB250
Zone	IV

4.1. Following are Various Study Cases Enrolled in Study:

Case 1: RC H-type Frame Structure

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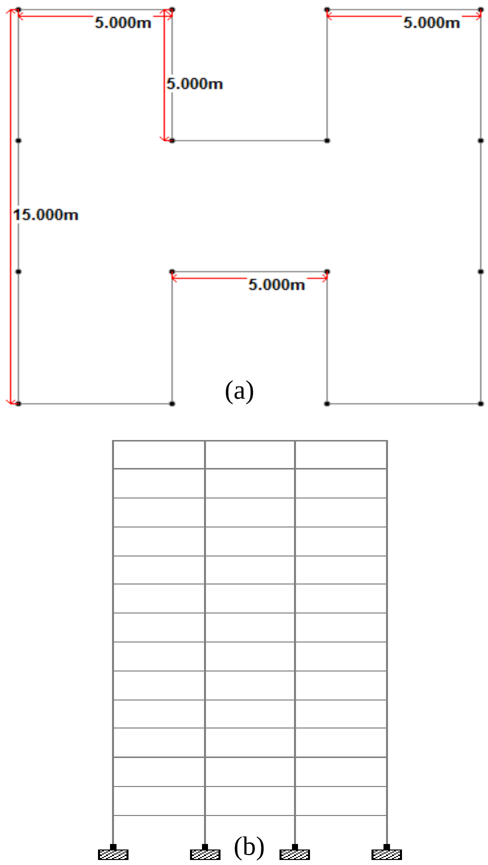

Fig. 1: Plan and Elevation of H Shape Bare Frame

Case 2: RC T Shape Frame Structure

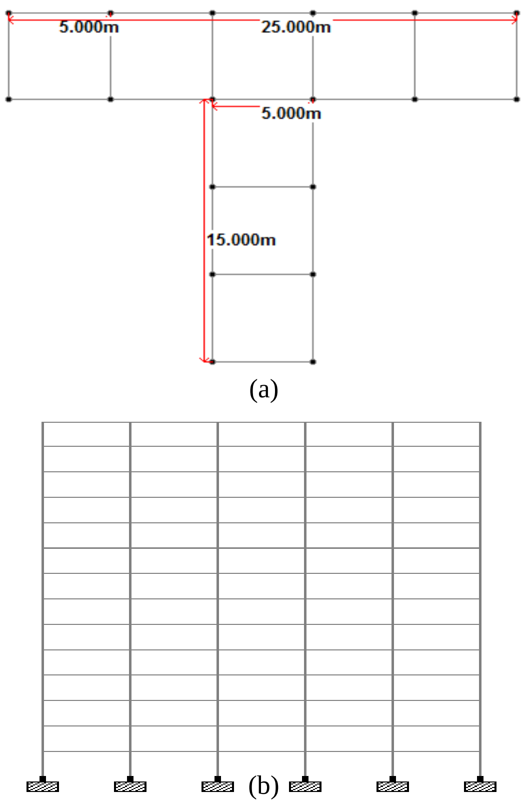

Fig. 2: Plan and Elevation of RC T Shape Frame

V. RESULTS AND DISCUSIONS

Deals with the results obtained from the H type and T type frames consisting of different configurations, when they were subjected to seismic excitations. The results then obtained from different frames were compared on the basis of base shear, storey drift and displacement.

Table 2: Case 1 RC Frame Structure

Parameters	Displacement (mm)	Storey Drift (mm)	Base Shear (kN)
H type Frame	310.857	0.007548	3027.54
T type Frame	357.451	0.011578	3347.52

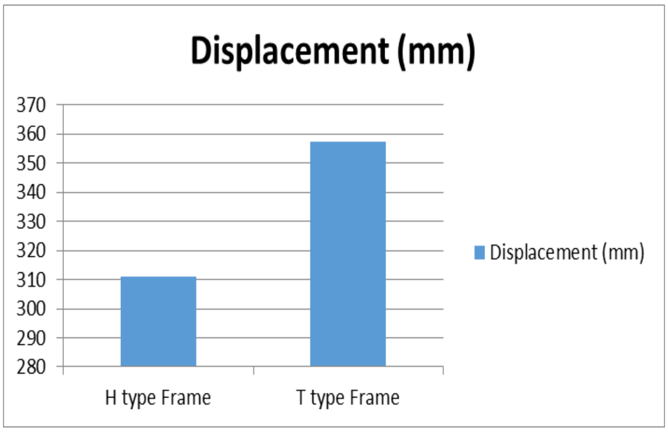

Fig. 3 Graph Representing Displacement Values for H-type and T-type Frames

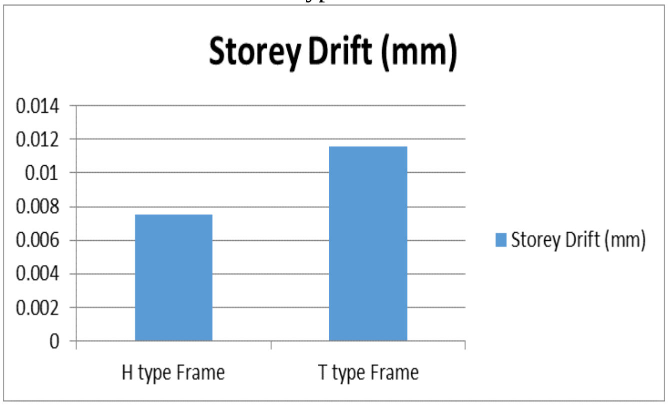

Fig. 4 Graph Representing Storey Drift for H-type and T-type Frames

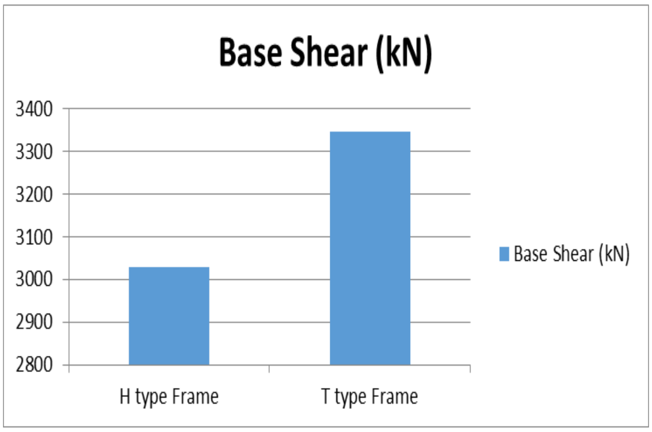

Fig. 5 Graph Representing Base Shear for H-type and T-type Frames

Case 2: RC Frame Structure with Combination of Shear Wall and Composite Bracing Systems

Table 3: Representing Displacement Values for H-type Systems for Various Composite Bracing and RC Shear Wall Systems

Types	Displacement (mm)	
	Zone III	Zone V
K - Core	112.569	193.854
V - Core	110.215	185.325
X - Core	93.308	160.985

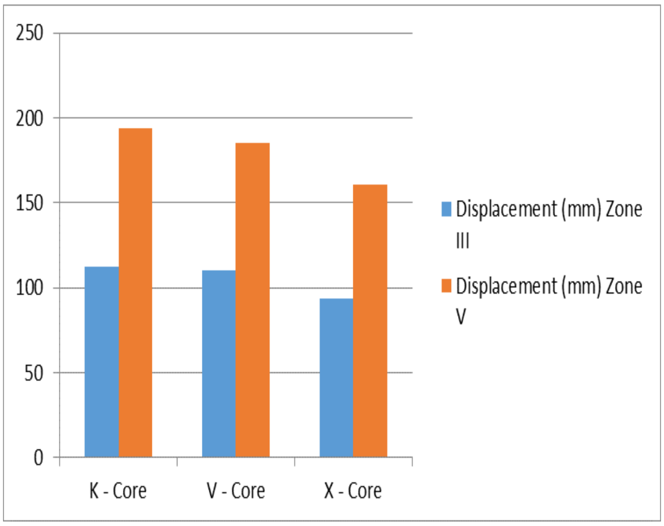

Fig. 6 Graph Representing Displacement Values for H-type Systems for Various Composite Bracing and RC Shear Wall Systems

VI CONCLUSION

Case 1: RC Frame Structure: Bare RC frame structures, H-type and T-type in plan were analyzed for dynamic analysis in Staad Pro V8i. It was found that the there is great significance in comparing the results of them on the basis of base shear, storey drift and displacement at nodes. The displacement was calculated for H-type frame as 310.857mm, whereas for T-type frame was calculated as 357.451mm. The storey drift was calculated for H-type frame as 0.007548mm, whereas for T-type frame was calculated as 0.011578mm. The base shear was calculated for H-type frame as 3027.54 kN, whereas for T-type frame was calculated as 3347.52 kN.

Case 2: RC Frame Structure with Different Shear Wall System and Composite Bracings: For this particular case, bracings and shear wall were united together in H type and T type frames so as to make more informative study and to have more accurate results for precise comparison. For H shape frames, several combinations were made, but among all united X type bracing and corner shear wall had shown best results in displacement as 63.458mm in zone III and 139.962mm in zone V. Similarly in T shaped frames, diamond shaped bracing with provision of shear wall at edges had shown least displacement as 75.145mm.

Similarly, as of storey drift, in H shaped frames, X - corner has best results as 0.00123mm in zone III as compared to other combinations showing the maximum displacement as 0.00267mm in X – Shear wall (T shaped) at edges.
In H shaped frame, X – core has maximum base shear as 3458.91kN whereas for X-corner has maximum base shear of 3678.15kN. In T type frames, maximum base shear was calculated as 4366.41kN.

VII. FUTURE SCOPE

In this research, attention was made on linear dynamic analysis for seismic excitation. But, non-linear dynamic analysis can also be performed on the frame structure for precise evaluation of results. So, non-linear time history analysis can also be performed. Also there can be option for wind analysis

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