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COMPARATIVE STUDY OF SEISMIC PERFORMANCE OF RCC AND STEEL FRAMED STRUCTURE

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Abstract: Recently, it is required to make the structure efficient, reliable and sustainable to all adverse circumstances. The most dangerous and disastrous one is earthquake. So, there is need to evaluate and improve the seismic performance of multistoried buildings. The structural type is now increasing for the pursuit of the economy, rationalization of structures and efficiency of construction now. There is several number of factors affecting the behavior of building which are required to be studied. In this paper we are dealing with comparative study of seismic analysis of RCC framed structure and steel framed structure. The equivalent static analysis is carried out in the study using the software and the comparison of these models are presented. The work will present elaborated view about the nature and performance of RCC and steel framed structure seismically.

Keywords: Seismic Analysis, RCC, Steel.

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INTRODUCTION

Reinforced Concrete (RC) has been the most popular construction material used worldwide in the past century. It has proven to be a wonderful construction material that possesses almost all of the desirable properties such as excellent insulation from environment, durability, low cost, ease of construction, ability to mould in any given shape to name a few. Even from structural aspects, reinforced concrete construction serves its intended purpose extremely well, if properly designed and constructed. However, the performance of reinforced concrete structures during past earthquakes has forced researchers to evaluate the suitability of the material to resist seismic excitations. As compared to the Reinforced cement concrete (RCC) the steel has got some important physical properties like the high strength per unit weight and ductility. The high yield and ultimate strength result in slender sections. Being ductile the steel structures give sufficient advance warning before failure by way of excessive deformations. These properties of steel are of very much vital in case of the seismic resistant design. Thus, a comparative study is necessary to be done from the point of view of seismic performance.

1. SINIFICANCE OF STUDY

In the past, for the design of a building, the choice was normally between a concrete structure and a masonry structure. But the failure of many multi-storied and low-rise R.C.C. and masonry buildings due to earthquake has forced the structural engineers to look for the alternative method of construction. So, it is necessary to study both the performances of RCC framed and steel framed structures in seismic conditions.

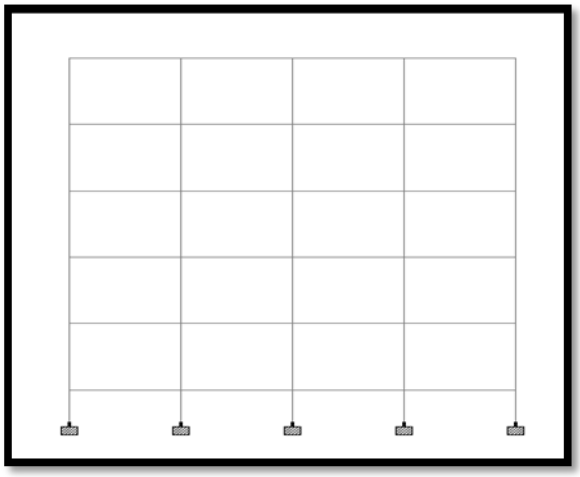


Fig.2.1 Framed structure

2. SCOPE OF STUDY

Three dimensional space frame analysis is carried out for two different framed structures such as;

1. RCC framed Building
2. Steel framed Building

Equivalent static analysis of these buildings, in terms of lateral displacement, storey drift & shear force is presented & compared within the considered configuration. At the end, a suitable configuration of building to be used is suggested.

4. BUILDING CONFIGURATION

Two different frames are considered,

1. RCC framed structure
2. Steel framed structure

The building plan is as shown in figure:

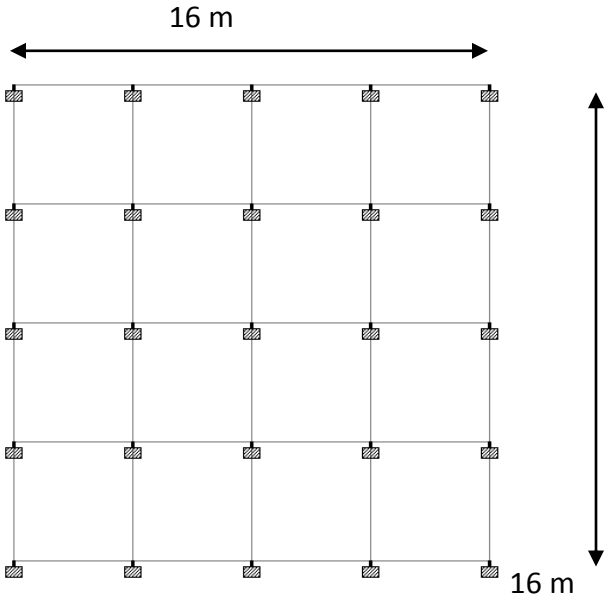


Table 4.1 Properties of members of different configurations of building:

Parameters	RCC Framed Structure	Steel Framed Structure
Plan dimensions	16m X 16m	16m X 16m
Total height of building	17m	17m
Beam sections	230mm X 400mm	ISHB 300
Column sections	300mm X 300mm	ISHB 350

5. METHOD OF ANALYSIS

The seismic analysis of all buildings are carried out by Seismic coefficient method by using

IS 1893(part I) -2002. The other parameters used in seismic analysis

a) Moderate seismic zone-III

b) Zone Factor = 0.16.

c) Importance Factor = 1

d) Response Reduction Factor = 5

Analyses of results In all, two buildings have been analyzed for seismic load. The seismic force was applied in X & Z direction independently.

Table 5.1 Lateral Displacements:

SR. NO.	STOREY LEVEL	RCC framed structure		Steel Framed structure	
		X- dir	Z - dir	X- dir	Z - dir
1	I	0.010	0.010	0.014	0.022
2	II	0.076	0.075	0.091	0.185
3	III	0.145	0.141	0.176	0.345
4	IV	0.203	0.199	0.249	0.484
5	V	0.248	0.240	0.303	0.585
6	VI	0.267	0.258	0.331	0.626

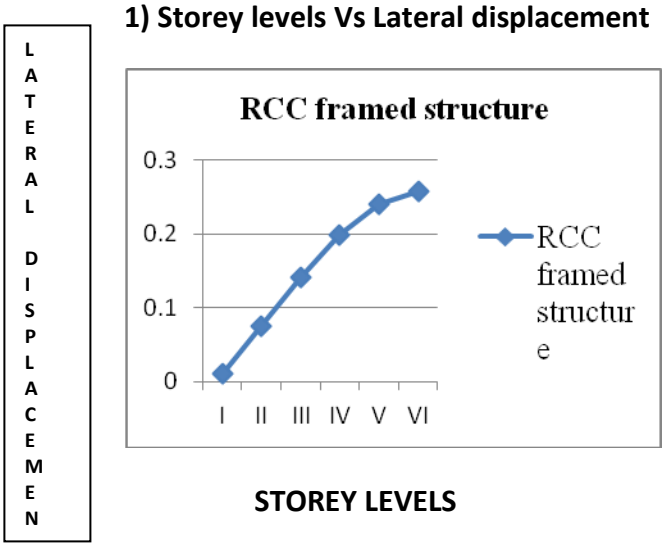
Table 5.2 Storey Drift:

SR. NO.	STOREY LEVEL	RCC framed structure		Steel Framed structure	
		X- dir	Z - dir	X- dir	Z - dir
1	I	0.010	0.010	0.014	0.022
2	II	0.066	0.065	0.077	0.163
3	III	0.069	0.067	0.084	0.161
4	IV	0.058	0.057	0.074	0.139
5	V	0.045	0.041	0.054	0.101
6	VI	0.020	0.018	0.027	0.040

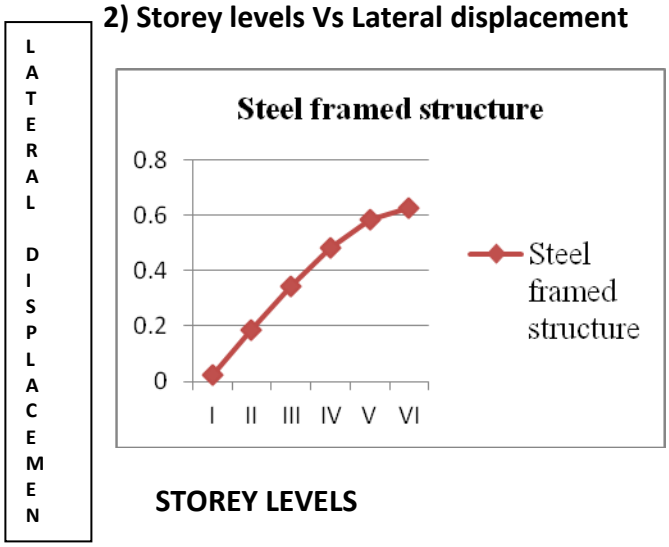
Table 5.3 Maximum shear force:

SR. NO.	STOREY LEVEL	RCC framed structure		Steel Framed structure	
		Max Fz (kN)	Max Fy (kN)	Max Fz (kN)	Max Fy (kN)
1	I	0.005	8.259	0.042	6.553
2	II	0.165	63.392	0.241	60.322
3	III	0.347	66.049	0.521	59.387
4	IV	0.529	62.247	0.768	56.873
5	V	0.665	59.598	0.902	56.892
6	VI	0.696	25.999	0.865	24.647

1) Storey levels Vs Lateral displacement



2) Storey levels Vs Lateral displacement



6. CONCLUSIONS

From the results obtained i.e. seismic analysis of RCC framed structure and Steel framed structures, it can be concluded as

1) Lateral displacements in longitudinal and transverse direction in RCC framed structures are less as compared to the Lateral displacement in Steel framed structures.

2) Steel framed structure will resist more lateral forces and will undergo deformation due to the property of ductility but at the same condition RCC framed structure will undergo cracks.

3) Storey drift in longitudinal transverse direction in RCC framed structures are less as compared to the Lateral displacement in Steel framed structures.

4) Shear forces in RCC framed structures are relatively less as compared to that in Steel framed structures.

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