International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

COMPARATIVE STUDY OF STOREY DRIFT IN RCC AND STEEL COMPOSITE FRAME STRUCTURE

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Abstract - Steel-Concrete composite constructions are very popular and having to their advantages over conventional Concrete and Steel constructions. Concrete structures are heavy and deflection are less whereas Steel structures are light as compare to the concrete structures provides more deflections and ductility to the structure which is serviceable in resisting earthquake forces. Composite Construction provide a very good properties of both steel and concrete along with lesser cost, fire protection etc. Hence the aim of the present study is to compare seismic performance of a G+7 story RCC, and Composite building frame situated in earthquake zone V. frames are plan for same gravity loadings. The RCC slab is used in all two cases. Beam and column sections are made of either RCC or Steel concrete composite sections. Equivalent static method and Response Spectrum method are used for the analysis. SAP 2000 software is used. Comparative study concludes that the composite frames are best among all the two types of constructions in terms of benefit added with better seismic behavior.

***Key Words*: RCC, steel-concrete composite, SAP2000, Slab Equivalent static method & Response Spectrum method.**

1. INTRODUCTION Country like India, most of the buildings fall under the category of low rise buildings. So, for these purpose reinforced concrete members are used widely because the construction becomes quite appropriate and economical in nature. But since the population of cities is growing very fast and the land is limited, there is a need of vertical growth of buildings. So, for the achievement of this purpose a large number of medium to high rise buildings are constructed. For these high rise buildings it has been found out that use of composite members in construction is more efficient and economic than using RCC Members. In India ,use of steel members are very less as compare to the other country like America china and Russia etc. Seeing development in India there is a need to improve the technique to use steel in the field of construction.

1.1 Problem Statements

Eight storey (G+7) building frame with three bays in horizontal and three bays in lateral direction is analyzed by Equivalent Static Method and Response Spectrum Method. The geometrical parameters of the building are as follows:

- Height of each storey = 3.8 m
- Center-to-center span between each column along X and Y direction = 5.5 m
- Fixed type support at the bottom. The loads on the building are as follows:

1. Dead Load:-
   i) Self weight of the frame.
   ii) Dead load of floors.
      (a) All the intermediate floors = 6.7 KN/m2
      (b) Roof floor = 5.5 KN/m2
   iii) Dead load of walls
      (a) On outer beams = 12 KN/m2
      (b) On inner beams = 6KN/m2
2. Live load
   i) All the intermediate floors = 4.1KN/m2
   ii) Roof floor = 1.5 KN/m2
3. Earthquake load in both the direction as specified in IS 1893: 2002.

1.2 The seismic parameters of the building

- Seismic Zone: V
- Zone factor 'Z' : 0.36
- Soil type= Type II (Medium Soil)
- Building Frame System: Moment resisting RC frame.
- Response Reduction Factor = 5
- Importance factor = 1
- Fundamental natural time period, $T= 0.075H^{0.75}$ (moment-resisting frame building without brick in the panels). Since H= 30 m ,hence T= 0.9170 sec along both directions.

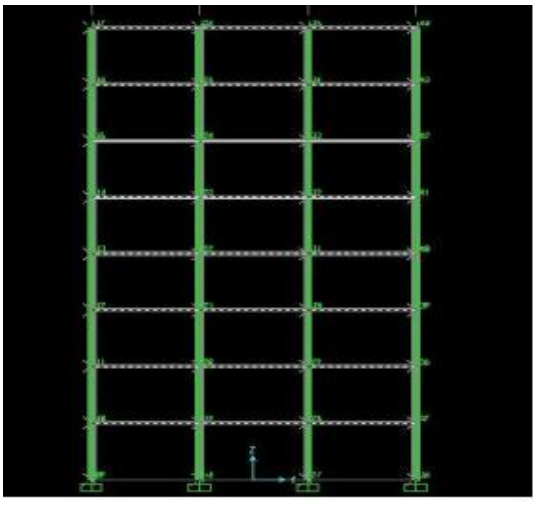


Fig-1: 2-D(y-z plane) model of the frame structure

2. Design and analysis

Table -1: SECTIONS USED IN THE STRUCTURES

Section	RCC	Composite
Column	0.45m x 0.75m Cross section	0.35m x 0.35 m with ISHB 250 steel section
Beam	0.3m x 0.4m	ISMB 250 with 125 mm thick concrete slab on top without shear connectors

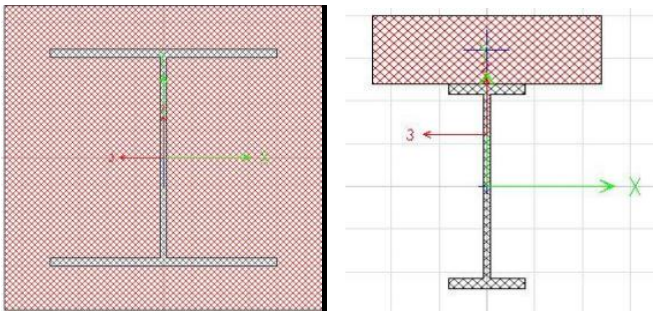


Fig-2: Column and Beam section of Composite frame

2.1 Equivalent Static Analysis: This method is based on the assumption that whole of the seismic mass of the structure vibrates with a single time period. The Mode of vibration of the Structure is assumed to be in its fundamental mode. But this method provides accurate results only when the structure is low rise and there is no significant twisting on ground movement.

2.2 Response Spectrum Analysis: Multiple modes of responses can be taken into account using this method of analysis. Except for very complex structure, this approach is needed in many building codes. The structure reacts in a way that can be defined as a combination of special modes. Dynamic analysis determines the modes of vibration. Response spectrum analysis is used to determine the storey drift of a frame structure. The results are obtained the maximum values of the displacements and member forces by the response spectrum method..

3. RESULTS AND DISCUSSION The frame is analyzed with dead and live loads for RCC sections for beams and columns in SAP 2000.

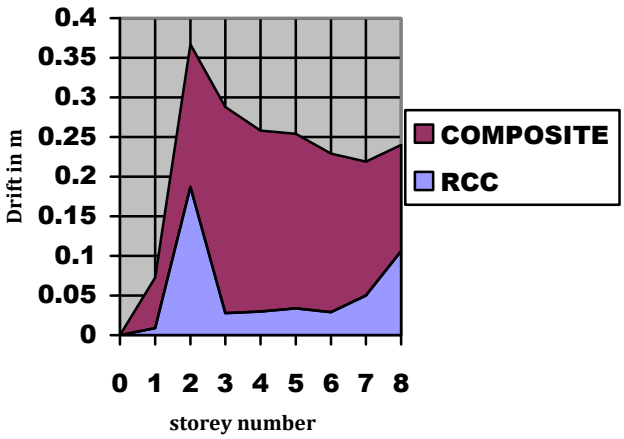
3.1 RESULTS Results obtained from the analysis are

3.1.1. Equivalent Static method

Table-2: Storey Drift due to Equivalent Static Analysis in X-direction

Storey number	Drift of RCC in X direction	Drift of Composite in X-direction
0	0	0
1	0.0087	0.0640
2	0.0187	0.18
3	0.028	0.26
4	0.030	0.228
5	0.034	0.220
6	0.029	0.200
7	0.05	0.169
8	0.0106	0.134

Storey Drift due to Equivalent Static Analysis in X-direction

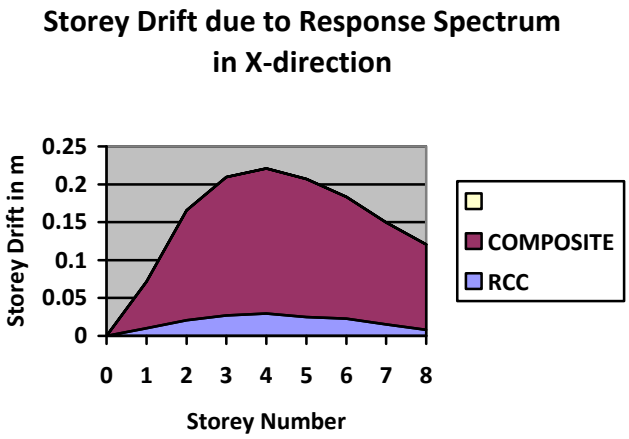


3.1.2 Response Spectrum Analysis:

Table-3: Storey Drift due to Response spectrum(X-direction)

Storey number	Drift of RCC in Xdirection	Drift of Composite in X-direction (m)
0	0	0
1	0.00998	0.06184
2	0.02083	0.14468
3	0.026794	0.18272
4	0.029302	0.19163
5	0.024971	0.1819

6	0.022575	0.16062
7	0.015002	0.13485
8	0.00791	0.112563



4. CONCLUSIONS

a) Storey drift in Equivalent Static Analysis in X-direction is more for Composite as compared to and RCC frames.

b) Story drift of RCC frame has the lowest values because of its high stiffness.

c) The differences in storey drift for different stories along X and Y direction are owing to orientation of column sections. Moment of inertia of column sections are different in both directions

d) Same storey drift patterns are obtained by using Response Spectrum method validating the results obtained by the Equivalent Static method.

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