Performance Analysis of Regular and Irregular Structure Under Seismic Effect for RCC and Steel Composite Column Using Response Spectrum

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Abstract*—Composite construction is a modern method of construction presently holds a wide area of interest. This paper includes performance analysis of regular and irregular structure under seismic effect for RCC and Composite column. Modeling and analysis of structure is done by using ETABS software. Since composite construction is combination of steel section and concrete, which shows the properties of both steel and concrete. The compression efficiency of concrete and high ductile properties of steel together contributes to the structure for its perfect durability.*

Keywords—Composite Column, ETABS.

I. INTRODUCTION

Composite construction has become common technique in the field of construction. Since it is a combination of steel sections and concrete which add ups the properties of structure in its durability as well as strength. It should be noticed that efficiency of tensional property of steel and resisting property against corrosion also adds up the overall behavior of the structure. We all know that steel section is more prone to buckling but concrete resist the buckling, together as a composite unit which contribute high strength for structure, hence composite structure holds a high value of safety.

II. COMPOSITE STRUCTURAL ELEMENTS

2.1 Composite beam

Composite beam is a part which connects slab and column together to form as a single united structure. The load from slab can be equally distributed to the beam. Composite beam can be produced by incorporating steel section in beam mould and reinforcing the same with certain grade of concrete. Shear connectors are main element in composite beam which acts same like shear reinforcement. The steel section can be kept inside the beam mould or filling material can be filled inside the steel section.

2.2 Composite column

These columns are same like RCC columns but instead of steel reinforcement steel sections are inserted. There are different types of steel sections are available, so based on insertion of steel section column name changes. Steel section can be inserted inside the column with filling material as concrete or hollow steel section are filled with filling material like concrete with suitable grades. Examples of different sections that can be encased with concrete are steel hollow pipe, steel tube sections, steel channel section and many more.

2.3 Composite slab

Composite slab, another member of composite structure which connects the beam and column together and forms as a structural unit. A trapezoidal deck is formed over beam with profiled sheets, reinforcement bars are laid and concreting is done above that. It provides a smooth working platform since profiled sheets are laid before concreting. There are mainly 2 types of decks available such as trapezoidal and Re-entrant steel deck.

III. MODELING AND ANALYSIS

ETABS-Regular plan models shown in Fig.1. and ETABS-Irregular plan models shown in Fig.2.

Case I: Regular plan with Rectangular composite column

Case II: Regular plan with Rectangular RCC column

Case III: Irregular plan with Circular Composite column

Case IV: Irregular plan with Circular RCC column

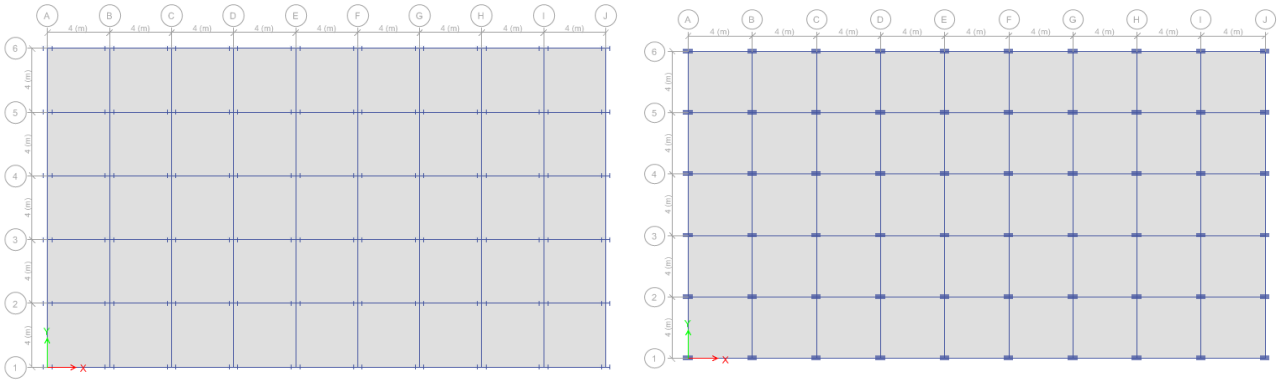

FIG.1: REGULAR PLAN MODELS MODEL FOR CASE I & II

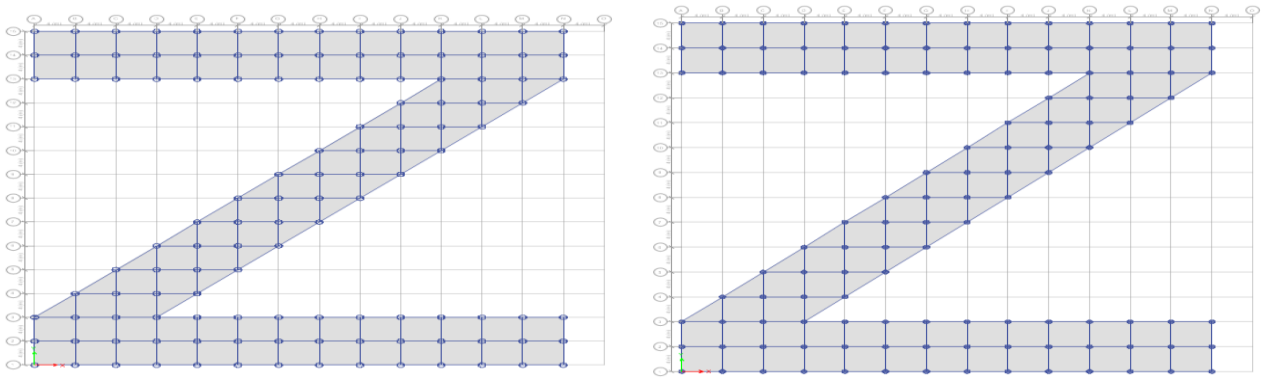

FIG.2: IRREGULAR PLAN MODELS MODEL FOR CASE III & IV

3.1 Model Description

TABLE 1
DETAILS OF MODEL

PLAN	REGULAR PLAN		IRREGULAR PLAN	
Column	RCC	COMPOSITE	RCC	COMPOSITE
Shape of column	Rectangular	Rectangular	Circular	Circular
Shape of plan	Rectangular	Rectangular	Z shape	Z shape
Floor Height(m)	3	3	3	3
Beam Size(mm)	300x600	300x600	300x600	300x600
Column size(mm)	300x600	300x600	600	600
Number of storey	7	7	5	5

TABLE 2
GEOMETRIC DETAILS OF MODEL

Type of structure	Multi storey RC and Composite structure
Grade of concrete column	M30
Grade of concrete Beam	M20
Grade of Reinforcement	Fe415
Floor Height	3m
Slab Thickness	125mm
Slab load	$3kN/m^2$
Number of storey	7(Regular) and 5(Irregular)
Type of composite column	Concrete encasement column
Embedded steel section	ISWB 550
Density of concrete	$25kN/m^2$

IV. RESULTS AND ANALYSIS

4.1 Comparison between Rectangular RCC and Composite column in Regular plan

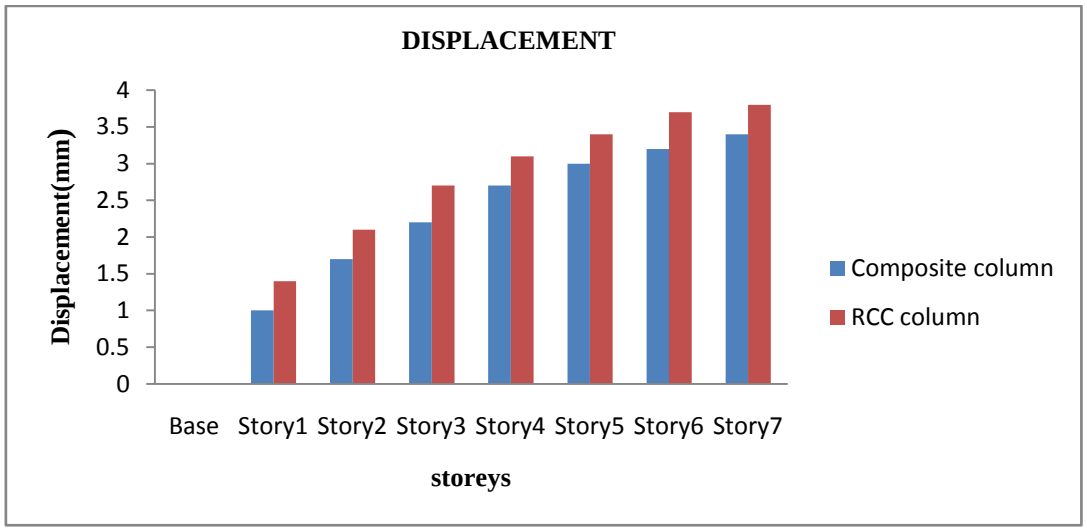

FIG.3: GRAPH OF STOREY VS DISPLACEMENT

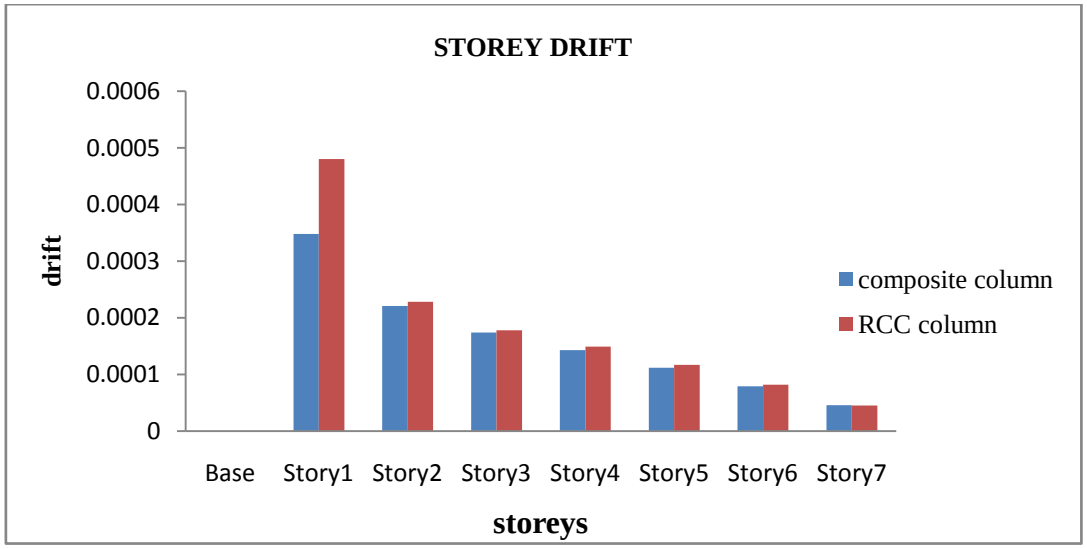

FIG.4: GRAPH OF STOREY VS DRIFT

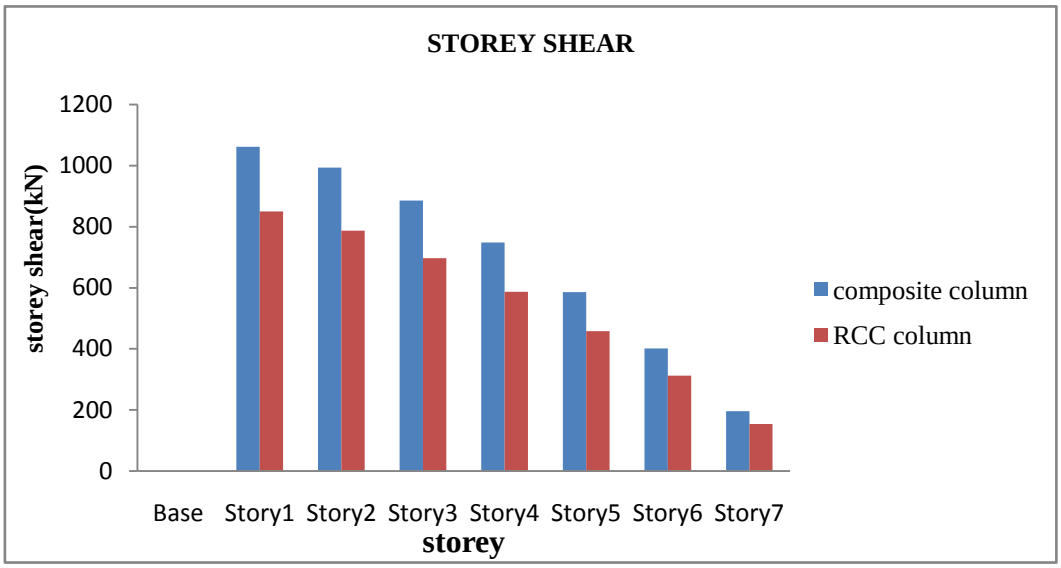

FIG.5: GRAPH OF STOREY VS SHEAR

4.2 Comparison between Circular RCC and Composite column in Irregular plan

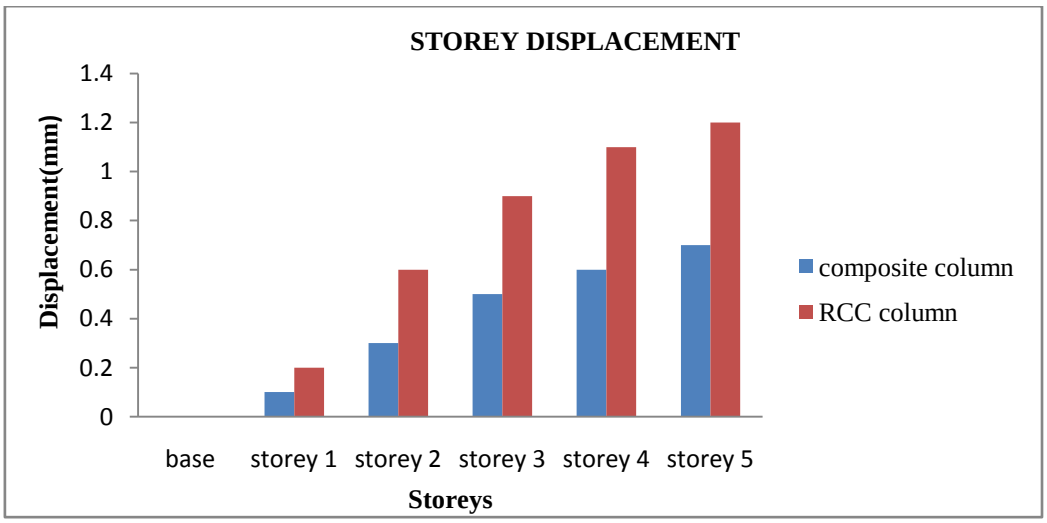

FIG.6: GRAPH OF STOREY VS DISPLACEMENT

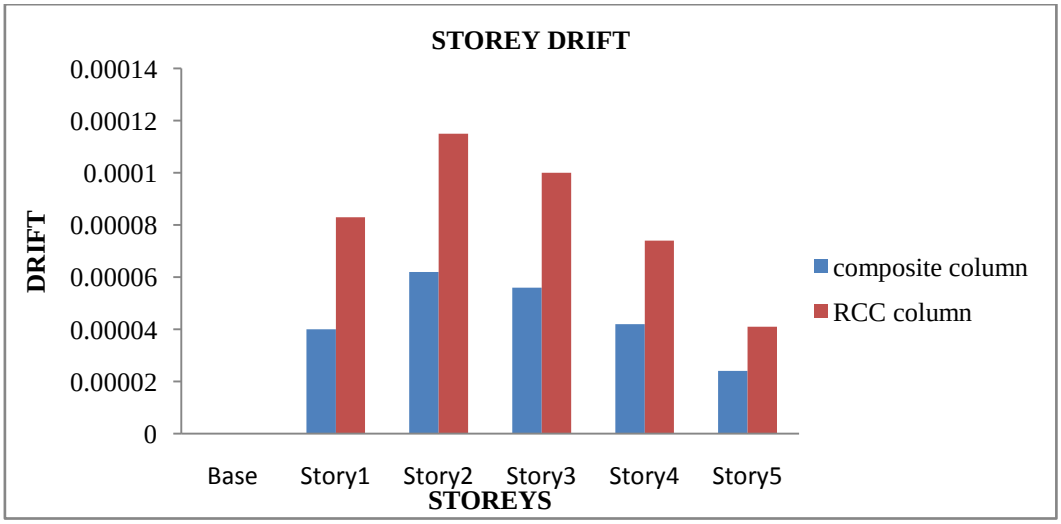

FIG.7:GRAPH OF STOREY VS DRIFT

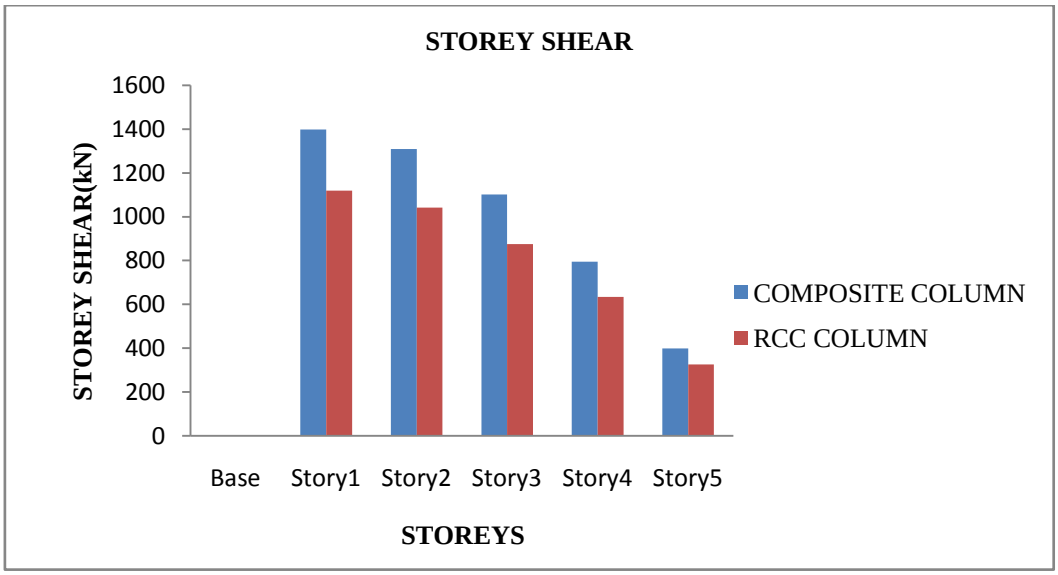

FIG.8:GRAPH OF STOREY VS SHEAR

V. CONCLUSION

- It is observed that displacement in regular structure having rectangular composite column is reduced to 40% to 50% as compared to same structure with rectangular RCC column.
- It is observed that shear in regular structure having rectangular composite column is increased to 60% to 70% as compared to same structure with rectangular RCC column.
- It is observed that drift in regular structure having rectangular composite column is increased to 35% to 40% as compared to same structure with rectangular RCC column.
- It is observed that displacement in irregular structure having circular composite column is reduced to 40% to 50% as compared to same structure with circular RCC column.
- It is observed that shear in irregular structure having circular composite column is increased to 60% to 70% as compared to same structure with circular RCC column.
- It is observed that drift in irregular structure having circular composite column is increased to 35% to 40% as compared to same structure with circular RCC column.

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