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Analytical review assessment of flat slab buildings with RCC and composite column

Abhijit Salunkhe, Niranjansingh Rajput, Aditya Kurle, Sakib Mulla, Poonam Patil, Shivanjali Digole
Assistant Professor, Department of Civil Engineering, P.V.P.I.T. Budhgaon, Sangli, India
U.G.Schlor, Department of Civil Engineering, P.V.P.I.T. Budhgaon, Sangli, India
U.G.Schlor, Department of Civil Engineering, P.V.P.I.T. Budhgaon, Sangli, India
U.G.Schlor, Department of Civil Engineering, P.V.P.I.T. Budhgaon, Sangli, India
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U.G.Schlor, Department of Civil Engineering, P.V.P.I.T. Budhgaon, Sangli, India

ABSTRACT:
Now a days in India due to lack of land we are adapting vertical construction like apartments and due to height limitations in construction of apartment the sufficient headroom is compromised, hence To overcome this problem "Flat slab" refers to a structural system used in buildings where the floors are supported directly by columns without beams. Flat slabs provide more headroom and flexibility in space planning since they eliminate the need for beams flat slabs are favored in construction for their simplicity, efficiency, and potential cost savings, especially in buildings where open spaces and flexibility in design are desired.
Numerous studies on the properly designed flat slabs and composite columns with adequate reinforcement can offer good structural strength and durability and also resists to earthquake loads. This paper focuses on broad literature review based on flat slabs and composite column helps to study of them in single paper.

Keywords: Flat Slab, RCC Column, Composite Column, Composite Structure.

I. INTRODUCTION

As cities in India grow taller, finding enough space is a big challenge. Apartments are getting taller, but that means less headroom inside. To fix this, builders are using a new way of building called 'flat slabs.' These slabs let floors sit directly on columns without needing beams. This paper looks at how good flat slabs are for buildings in India. They give more room inside and make it easier to plan spaces.

Flat slabs are popular because they're simple, cost less, and let designers create open and changeable spaces. This study explores how well flat slabs work in Indian cities. It shows why they're a smart choice for making the most of space and making buildings better in crowded cities.

I. METHODS OF DESIGN OF FLAT SLAB

1. METHODS OF SEISMIC ANALYSIS

A. Linear static analysis
B. Linear dynamic analysis

II. PROBLEM FORMULATION, MODELLING AND ANALYSIS

Following are the models used for analysis

Case 1)-

i. 8 storey Flat Slab RC structure having plan dimensions 20m x20 m.
ii. 8 storey conventional RC Framed structure having plan dimensions 20 m x20m.
iii. 8 storey flat slab with composite column section having plan dimensions 20 m x20

All above model are analysed and comparison is made between these analyses. To know vulnerability of the structure to seismic loading.

Details of Modelling:

i. Storey height -3m
ii. Thickness of flat slab- 150mm
iii. Thickness of drop is -170mm.
iv.

Loading Details:

1. Gravity loads-
   i. Live load at typical floor-4 kN/m^2
   ii. Live load at top floor -2 kN/m^2
   iii. Floor finish load at typical floor -1.0 kN/m^2
   iv. Floor finish load at top floor -2.0 kN/m^2
2. Detail of Earthquake loading-

1. Static analysis

a. Location of zone- III.
b. The direction of excitation -X.
c. Importance factor -1
d. Response reduction factors- 5

2. Dynamic analysis-

a. Location of zone- III.

b. The direction of excitation -X.

c. Damping-5%.

III. RESULTS

STORY DISPLACEMENT

Story displacement is the absolute value of displacement of the story under action of the lateral forces. The importance of story drift is in design of partitions/ curtain walls.

MAXIMUM STORY DISPLACEMENT			
STORY	RCC BUILDING	FLAT SLAB	COMPOSITE STRUCTURE
1	2.7	1.7	3.5
2	6.8	5	6.1
3	10.9	8.7	8.4
4	14.8	12.4	10.6
5	18.3	15.9	12.6
6	21.4	19	14.3
7	24	21.6	15.8
8	25.8	23.6	16.9
9	27	24.9	17.6

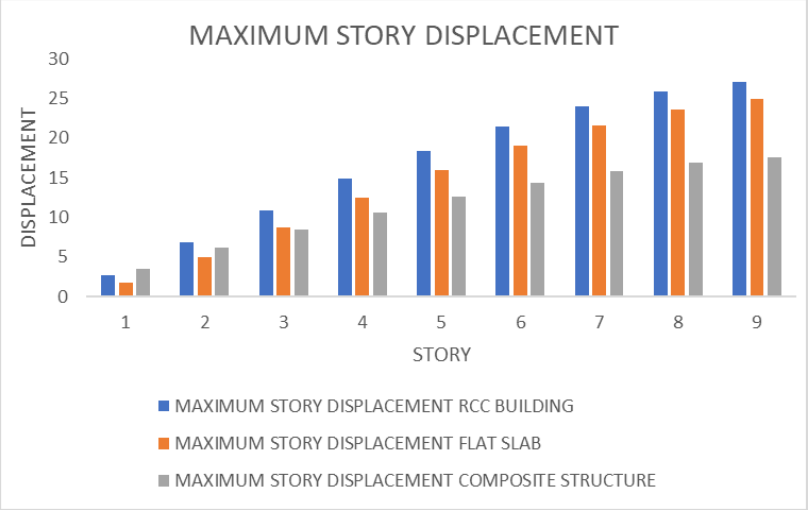

Fig.STORY DISPLACEMENT

STORY DRIFT

Story drift is the difference of displacements between two consecutive story divided by the height of that story.

MAXIMUM STORY DRIFT			
STORY	RCC BUILDING	FLAT SLAB	COMPOSITE STRUCTURE
1	1	1	1
2	4.1	3.3	2.6
3	4.1	3.7	2.3
4	3.9	3.5	2.2
5	3.5	3.7	2
6	3.1	3.5	1.7
7	2.6	2.6	1.5
8	1.8	2	1.1
9	1.2	1.6	0.7

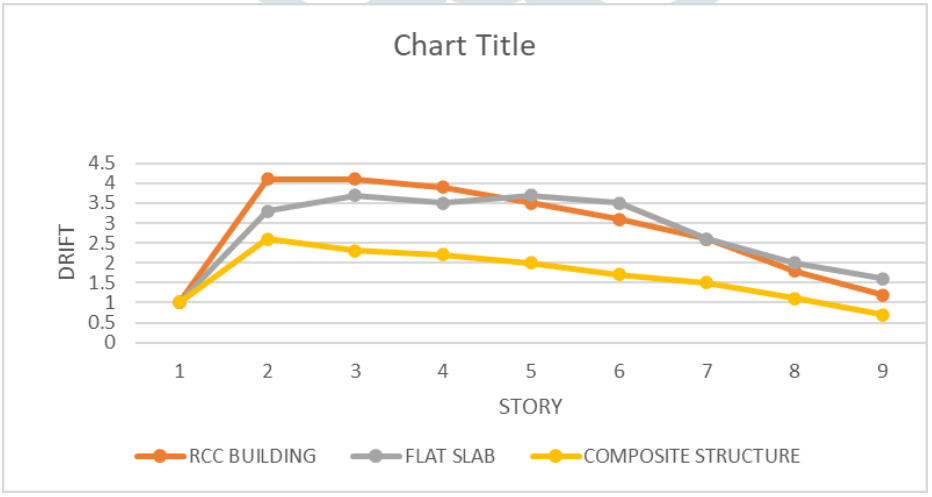

Fig.STORY DRIFT

BASE SHEAR

Base shear is an estimate of the maximum expected lateral force on the base of the structure due to seismic activity. It is calculated using the seismic zone, soil material, and building

BASE SHEAR			
STORY	RCC BUILDING	FLAT SLAB	COMPOSITE STRUCTURE
1	426.6697	266.0231	231.6443
2	425.1407	265.0648	230.8073
3	419.0249	261.2316	27.4594
4	405.2642	252.6069	219.9265
5	380.8008	237.2742	206.5348
6	342.5766	213.3169	185.6102
7	287.5339	178.8183	115.4787
8	212.6147	131.8618	114.4665
9	114.761	70.531	60.8995

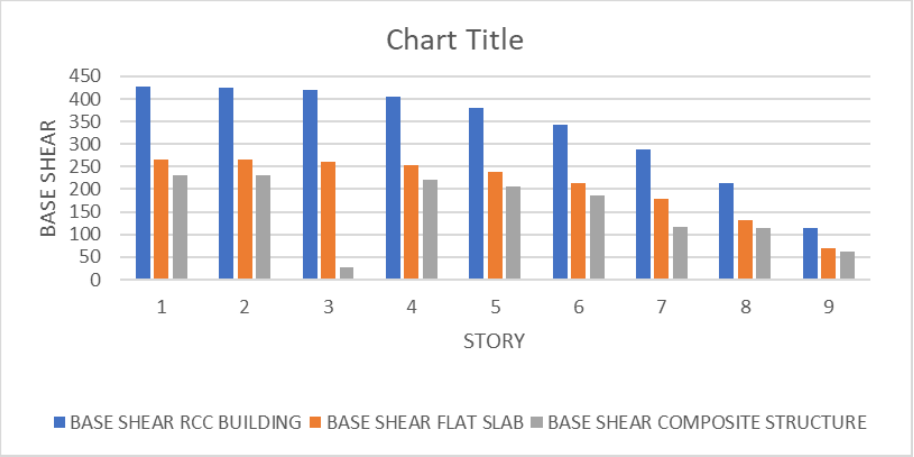

Fig. BASE SHEAR

IV. CONCLUSION

1. In case of 8 story structure story drift values for flat slab structure are well within permissible limit
2. Flat slab undergoes maximum displacements **as** compared with flat slab with composite column.
3. The maximum displacement values for any above structure does not found to be exceed the maximum permissible limit as per IS 1893.
4. The provision composite column to flat slab structure, shows that displacement and drift value to be minimum.
5. The provision composite column imparts uniform lateral stiffness to structure, thus make it as safer side.

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