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Comparitive Study of Seismic Analysis Between Conventional and Flat Slab with Drop and without Drop Framed Structures with Different Masonary Infills

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***Abstract:*-Most of the high-rise buildings in India consist of moment resisting frames with brick infill. But the brick infill is a non-structural element and therefore all the lateral load is assumed to be resisted by the frame. A brick infill is brittle when compared with reinforced concrete frame and fails in an earthquake, the lateral failure can be controlled by using masonry infill such as shear wall, strut and Bracings etc.**

If the structure is suitably designed, the infill can increase overall strength, lateral resistance and energy dissipation of the structure; and these infill reduces lateral deflections and bending moments in the frame, thereby decreasing the probability of collapse. Hence, accounting for the infill in analysis and design leads to slender frame members, reducing the overall cost of the structural system. Designers often neglect the structural contribution of infill, codes of practice, which do not recognize the effect of infill panels, recommended that the base shear be calculated based on the natural period of frame alone. Besides being unrealistic, such an approach can lead to unsafe design, because frame members receive unintended shear and axial force.

The present study is an attempt to study the comparative seismic analysis of conventional, flat slab with drop and without drop framed structures with and without masonry infill wall using *ETABS* software. The parameters studied are Fundamental natural period, Design Base shear, Displacements and Story Drift for different types of building with and without Masonry infill wall.

***Keywords*: E-Tabs, Flat Slabs, Infill walls, Conventional slabs, Base Shear, Story drift, Time Period.**

1. INTRODUCTION:

Reinforcement concrete is the major construction material in all civil engineering structures. Earthquake resistance design of these RC structures is a continuous area of research since the earthquake engineering has started. The structures still damage due to one or more reasons during Earthquakes. The reasons to damage the structure either code imperfections or errors in analysis and design. The structural configuration system has played a vital role Earthquake resistance design.

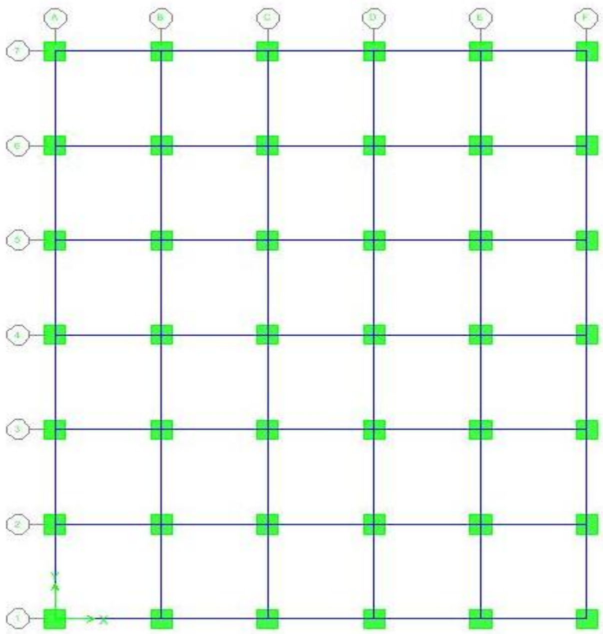
Flat slab structures are one of the most popular floor systems in commercial buildings, residential buildings and many other structures. The Flat slab framed structures are favored by both architecture and client. In conventional framed structures slab is resting on the beams, forces is transferred from slab to beams and then beams to columns. But in Flat slab framed structures forces is transferred from slab to the columns directly. By using the masonry infill we can overcome lateral failure in the multistory buildings during earthquake.

2. BUILDING CONFIGURATION:

Building Properties	Type of structure	
	conventional	flatslab
Building Height(m)	108	108
No of stories	30	30
Story Height	3.6	3.6
Grade of concrete	M40	M40
Grade of steel	Fe500	Fe500
Size of Beams(mm)	450*750	600*900
Size of coloumns	1200*1200mm up to 10 stories	1200*1200mm up to 10 stories
	1000*1000mm (11 to 20 stories)	1000*1000mm (11 to 20 stories)
	800*800mm (21 to 30 stories)	800*800mm (21 to 30 stories)
Size of Struct	1.5 m up to 10 stories	1.5 m up to 10 stories
	1.4 m up to 10 stories	1.4 m up to 10 stories
	1.3 m up to 10 stories	1.3 m up to 10 stories

Size of Bracing	230*300 mm	230*300 mm
Size of Shear Wall	230 mm	230 mm
width	30 m	36 m
Length	30 m	36 m

Figure 2.1 Plan of building



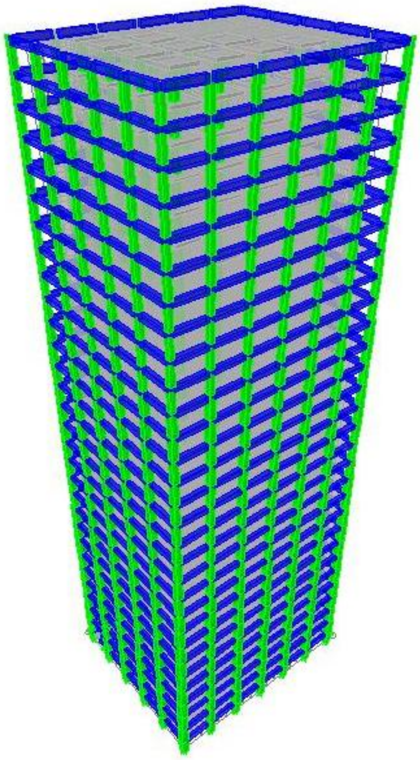


Figure 2.2 Model of building without Masonry

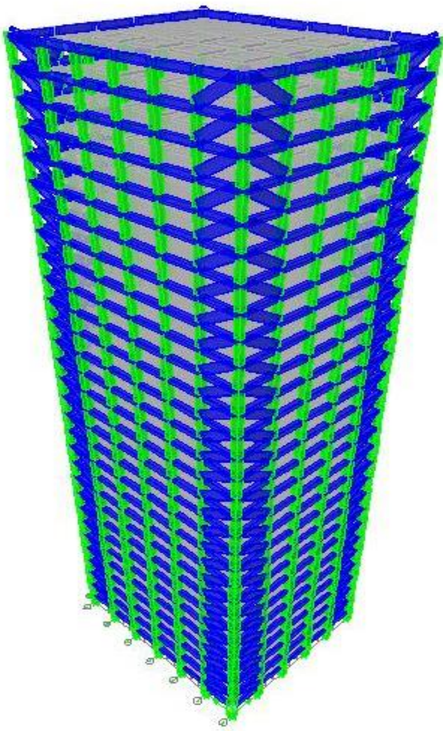


Figure 2.3 Model of building with struct

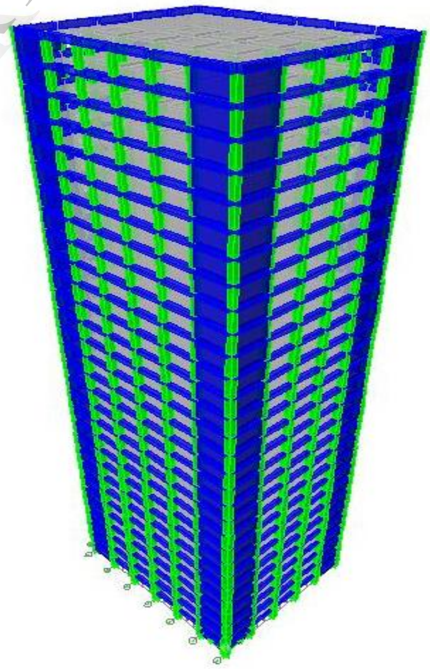


Figure 2.4 Model of building with shear wall

Infill Wall

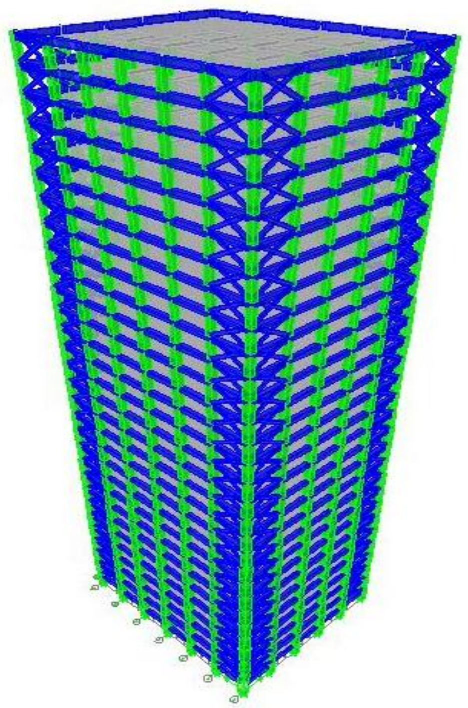


Figure 2.5 Model of building with X-bracing

3. Loading:

Live load	4 kN/m²
Floor finish	1.5 kN/m²
Wall weight	13.8 kN/m
	6.9 kN/m on roof
Seismic loading:	IS 1893
Zone factor	0.24 (zone IV)
Soil type	II
Importance factor	1.5
Response reduction, R	5
Ecc. Ratio	0.05
Wind loading:	IS 875
Wind speed	39 m/s
Risk coefficient K1	1
Terrain category type K2	4
Topography K3	1.05

4. Type of masonry infill:

1. Equivalent Diagonal Struct
2. Bracing System
3. Shear Wall

Equivalent Diagonal Struct can be calculated by using the formula:

$$\alpha_h = \frac{\pi}{2}\sqrt[4]{\frac{4E_f I_c h}{E_m t \sin 2\theta}}$$

Where, αh =Length of contact between the wall and column.

αL = Length of the contact between the wall and beam.

$$w = \frac{1}{2}\sqrt{\alpha_h^2 + \alpha_L^2}$$

W= Width of the strut

A member in which the relative displacement is effectively prevented by bracings. To resist the torsional effect of wind and earthquake forces, bracings in plan should be provided and integrally connected with the longitudinal and transverse bracings, to impart adequate torsional resistance to the structure.

$$\alpha_L = \pi\sqrt[4]{\frac{4E_f I_b h}{E_m t \sin 2\theta}}$$

A Shear Wall is a wall that is designed to resist shear, the lateral force that causes the bulk of damage in Earth Quakes. In Multi story structures, Shear walls are critical, because in addition to preventing the failure of exterior walls, they also support the multiple floors of the building, ensuring that they do not collapse as a result of lateral movement in an earthquake.

4. RESULTS AND DISCUSSIONS:

The study examines the performance of multistory buildings with different slabs like Flat slab framed structures and conventional framed structures with different masonry infills such as Equivalent diagonal strut, bracing system, shear wall systems. In this present study the dynamic analysis of different framed structures is done by response spectrum method.

Model 1: Structure without masonry infill
Model 2: Structure with considering Equivalent Diagonal Strut
Model 3: Structure with considering Shear wall
Model 4: Structure with considering Bracing system

Displacement:

Table 5.1. Maximum Displacement for Different types of buildings

	DISPLACEMENT		
STRUCTURE	CONVENTIONAL	FLAT WITH DROP	FLAT WITHOUT DROP
MODEL 1	0.0508	0.0555	0.0705
MODEL 2	0.0448	0.0448	0.0547
MODEL 3	0.0419	0.0411	0.0437
MODEL 4	0.0455	0.0452	0.0526

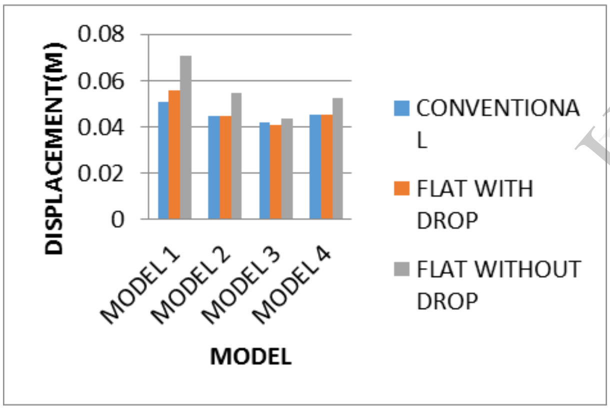


Fig 5.1. Maximum Displacement for different type of buildings without and with infill wall.

Base Shear:

Table 5.2 Design base shear for different type of buildings.

	BASE SHEAR		
STRUCTURE	CONVENTIONAL	FLAT WITH DROP	FLAT WITHOUT DROP
MODEL 1	6629.04	6132.32	5536.07
MODEL 2	7942.81	7369.16	6036
MODEL 3	9191.64	8718.27	7952.67
MODEL 4	7281.39	7051.86	6019.62

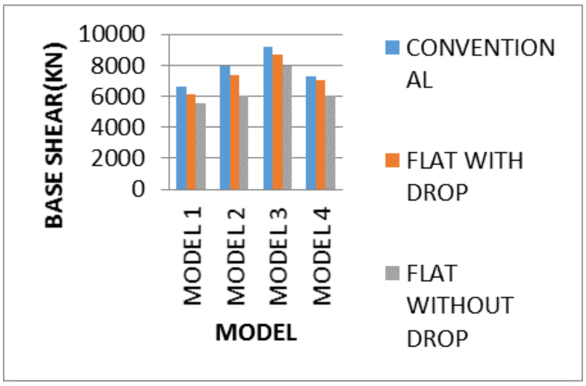


Fig 5.2 Design base shear for different type of buildings without and with infill wall.

Time Period:

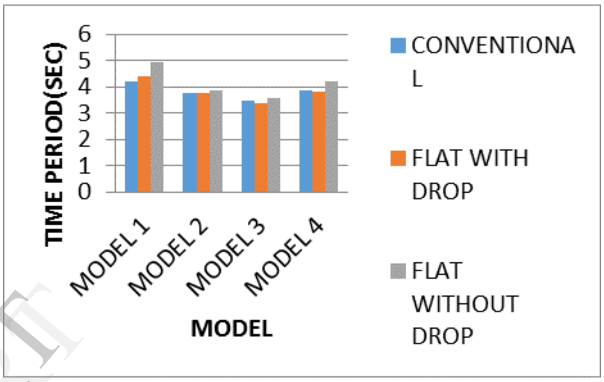


Fig 5.3 Fundamental Natural Period for different type of Buildings without and with infill wall.

Story Drift:

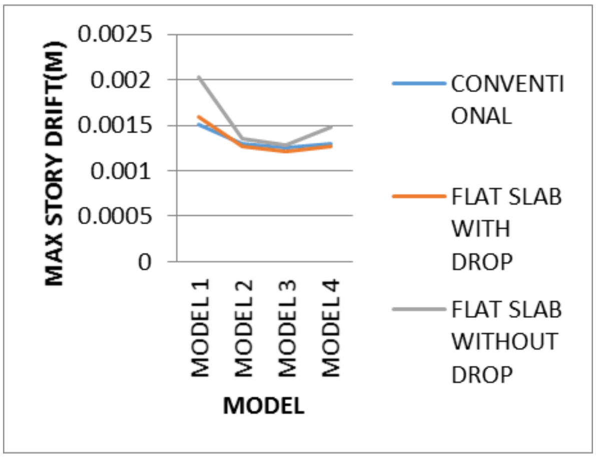


Fig 5.4 Maximum story drift for different type of buildings Without and with infill wall

6. CONCLUSION AND DISCUSSIONS:

1. By observing the above results the displacement of the structure is varies with varying the slab system and masonry infill system. The displacement of the flat slab with drop structures are having more deflection than conventional and flat slab with drop framed structures.
Model 1 is 22 % higher than model 2, 38% higher than the model 3, 25% higher than the model 4
2. Base shear of the conventional framed structures are having more than Flat slab with drop and without drop framed structures. Conventional framed structures are having 7% more base shear than Flat slab with drop framed structures and 16% more than flat slab without drop framed structures, the structure with shear wall is having more Base shear than the structures having with struct and bracing.
3. Flat slab without drop framed structures are having more Time period than the conventional and flat slab with drop framed structures, without masonry infil structures are having more Time period than the with masonry infill structures.
4. Story drift is decreased by using the masonry infill, story drift is higher in structures having without masonry infill than with masonry infill structures

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