Study on Dynamic behavior of Flat, Conventional and Grid Slab of R.C.C. Structures for Regular & Irregular in Plan with & without Bracing by Response Spectrum and Time History analysis

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Abstract: Recently there has been a considerable increase in the number of unsymmetrical building in plan, both residential and commercial. The slab may be supported directly on wall, on reinforced concrete beams usually cast monolithically with the slab, on structural steel beams, on directly columns, or on the ground surface. Slabs may be classified in different types used in different structures. Flat slab, Grid slab and Conventional slab are one of them. The object of the present work is to do Response Spectrum analysis and time history analysis of multi-storey buildings having Flat slabs, Grid slab and Conventional slab system for G+19, G+24 and G+29 with various plan irregularities, with and without Bracing and in two different zones i.e. zone IV and zone V with medium soil type conditions. Software ETABS 2016 is used for this purpose. The parameters considered are Maximum Storey Displacement & Base shear.

Index Terms **- Conventional slab, Flat slab, Grid slab, Bracing, C-shape, L-shape, Response spectrum, ETABS 2016.**

I. INTRODUCTION

Generally, there are three types of slab as per the requirement and uses i) Conventional, ii) Flat, iii) Grid slab. Flat slab is a reinforced concrete element supported directly on columns or on the drop panels used above the column. There are no beams in a flat slab. Conventional slabs are generally rectangular in shape. Grid slabs consist of intersecting beams at consistent intervals in both direction and it's monolithically slab.

The rapid growth of the urban population and scarcity of space have considerable influence the development of vertical growth consisting of low rise, medium rise and high-rise buildings. Reinforced concrete structures are always subjected to gravity and lateral load that are live load, dead load, superimposed load, and lateral load are such as seismic load and wind load.

To assure more strength of reinforced concrete structures commonly bracing is used because bracing is highly efficient for resisting horizontal forces in a reinforced concrete structure.

Irregular building are broadly classified into plan irregularities and Vertical irregularities. In this type of structure there may be uneven distribution of mass, strength and stiffness in plan as well as in elevation.

II. OBJECTIVES

- To find Response of reinforced structure with different slab system under seismic load.
- To find Response of reinforced structure with regular and irregular plan.
- To analysis (Parameter - Maximum Storey Displacement, Base Shear) of the Structure.

III. LITERATURE REVIEW

[2]Mr. Tejas B, Mr. Raghu, investigated that the storey displacement for grid slabs with zone V seismic intensity has a lesser displacement value. Grid slab structure increase in the stiffness of building

[5]Daksh S. Davda, Pravin L. Hirani investigated that Base Shear for Response spectrum analysis is more in flat slab. Base Shear for Response spectrum analysis is more in rectangular shape than C-shape building

[9]Navjot Kaur Bhatia, Tushar Golait, investigated that Flat slab values are better in hexagonal geometry in plan of the building. Resistance against lateral load is more in flat slabs.

[7]Mohammed Fatir, M.H. Kolhar, investigated that the drift value un zone IV is more compare to zone III foe all the Different types of building. The structure with Shear wall having 13% to 15% less drift value.

IV. METHODOLOGY

In the present work the analysis of following structures with different type of slabs is been carried out present work.

i) Flat slab system
ii) Conventional slab system
iii) Grid slab system

The plan areas of the all structures are same for the analysis; also, the beam and column dimensions are same. The materials such as Poisson ratio, Density of RCC, Density of Masonry, Young's modulus, compressive strength of steel and concrete etc. are kept constant in all building.

DYNAMIC ANALYSIS OF BUILDING

➢ Regular Building Rectangular in Plan with & without bracing.

- 20 Story Building
- 25 Story Building

- 30 Story Building

➢ Irregular Building C & L-Shaped in Plan with & without bracing.

- 20 Story Building
- 25 Story Building
- 30 Story Building

Comparison of the parameters considered in the study of regular as well as the irregular type structures.

- The static analysis and the dynamic analysis of the regular as well as irregular structure with and without bracing with different type of slabs should be carried out.
- The both structures should be analyzed according to the different seismic zones.
- The result parameter includes the base shear, displacement, moment etc. which are be compared.
- **Structure and Section details:**

Plan dimension (Rectangular shape)	42m * 25m
Plan dimension (C&L-shapes shape)	42m * 25m
Number of arms in x-axis	7
Number of arms in y-axis	5
Arm length in x-axis	6m
Arm length in y-axis	5m
Height of the floor	3m
Bracing thickness	300 mm * 300mm
Concrete grade in column	Conventional and Grid M25, Flat M30
Concrete grade of beam	M25
Concrete grade of slab	M20
Grade of steel	Fe – 500
Beam	300 mm * 500 mm
Column	650 mm * 650 mm
Slab thickness	Conventional – 150 mm, Flat – 200 mm, and Grid – 100 mm
Panel size	6m * 5m
Dead load	Default values taken by E-Tabs
Live load	4 KN/m^2
Floor finish	1.5 KN/m^2
Wall load	13.86 KN/m
Importance Factor (I)	1
Response Reduction Factor (R)	5

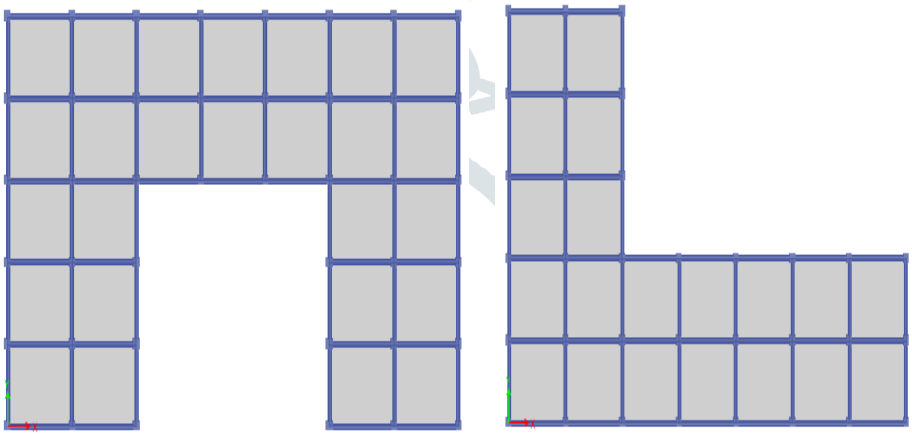


Fig: 1 C & L-Shaped in plan

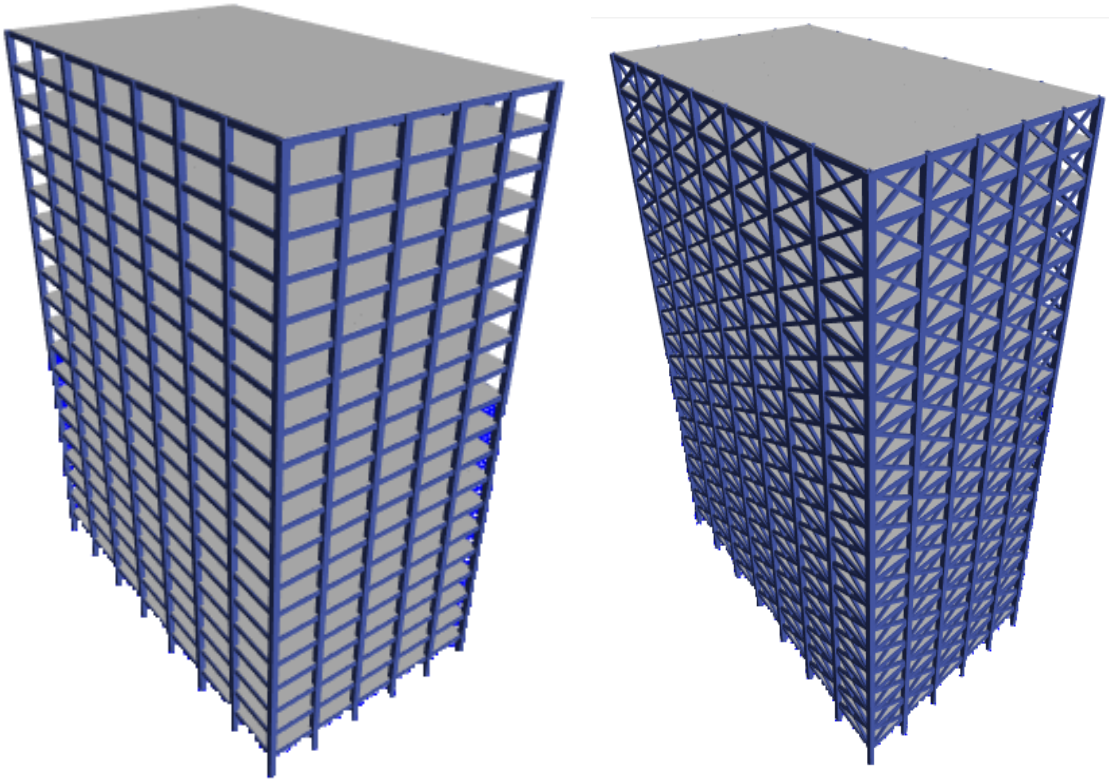
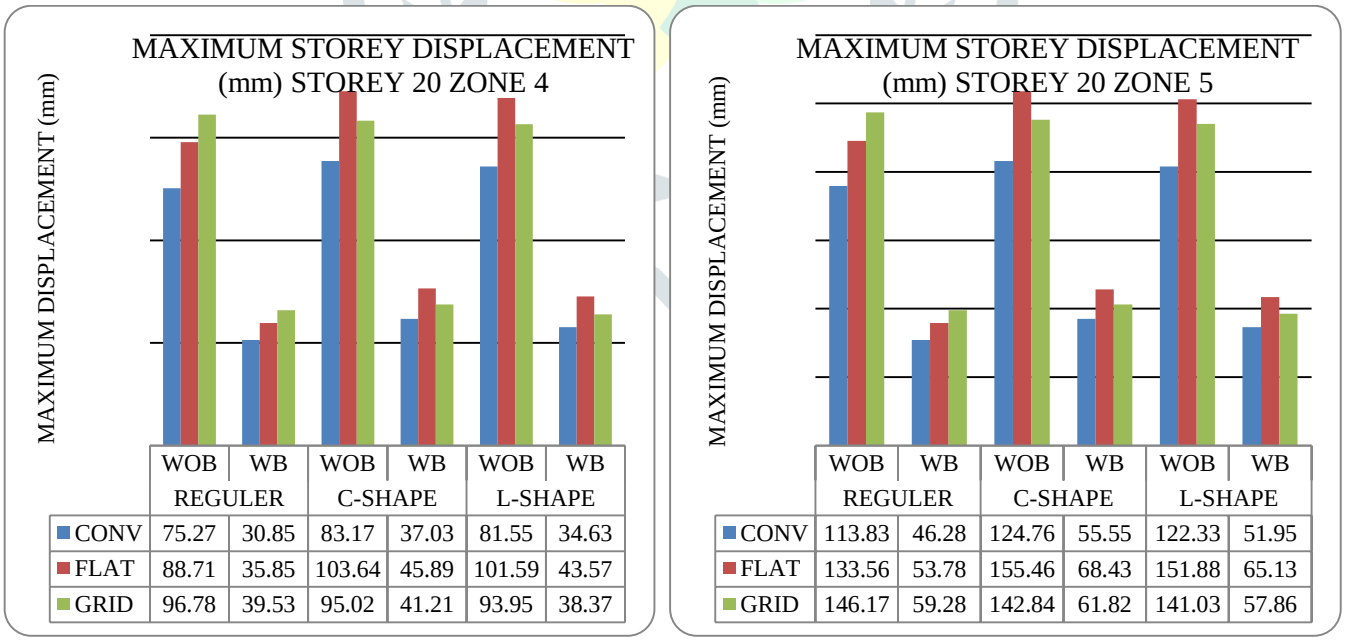


Fig: 2 Rectangular in plan with & without Bracing

V. RESULTS

The analysis results of multi story building with Conventional , Flat and Grid slab subjected to seismic forces in zone IV and V are as below of with bracing (WB) and without bracing (WOB) having rectangular and C-shape structure.

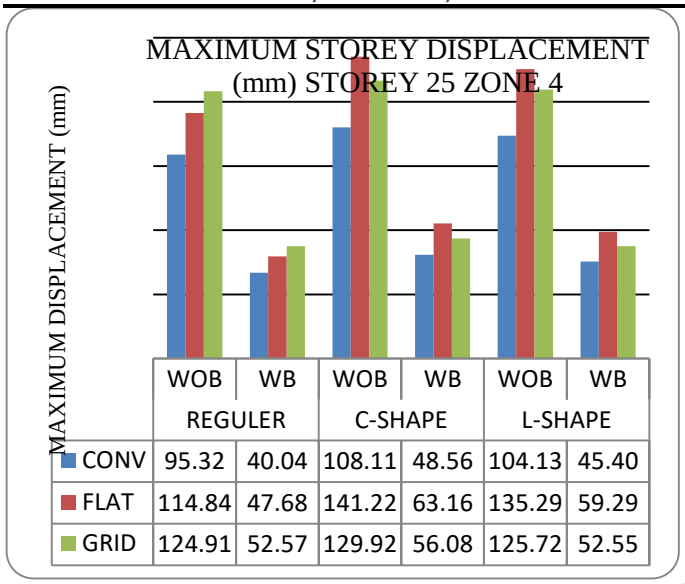
- **Maximum Storey Displacement:**



	WOB	WB	WOB	WB	WOB	WB
	REGULER		C-SHAPE		L-SHAPE	
CONV	75.27	30.85	83.17	37.03	81.55	34.63
FLAT	88.71	35.85	103.64	45.89	101.59	43.57
GRID	96.78	39.53	95.02	41.21	93.95	38.37

	WOB	WB	WOB	WB	WOB	WB
	REGULER		C-SHAPE		L-SHAPE	
CONV	113.83	46.28	124.76	55.55	122.33	51.95
FLAT	133.56	53.78	155.46	68.43	151.88	65.13
GRID	146.17	59.28	142.84	61.82	141.03	57.86

Fig: 3 Maximum Storey Displacement 20 Storey (Zone IV & Zone V)



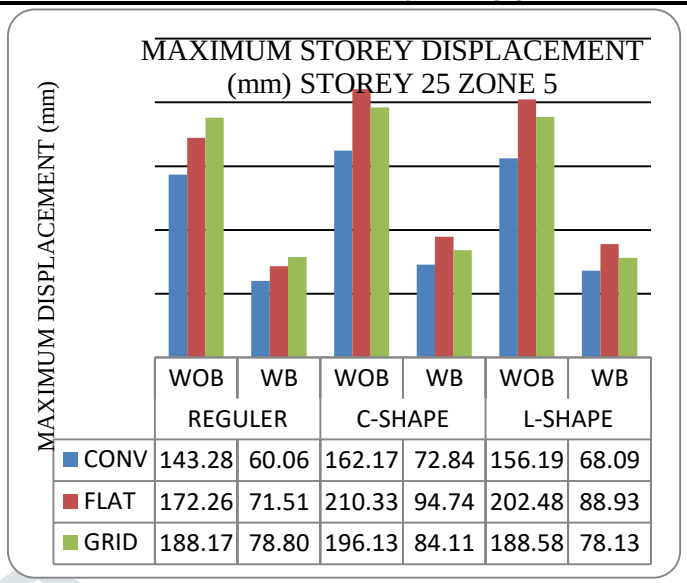
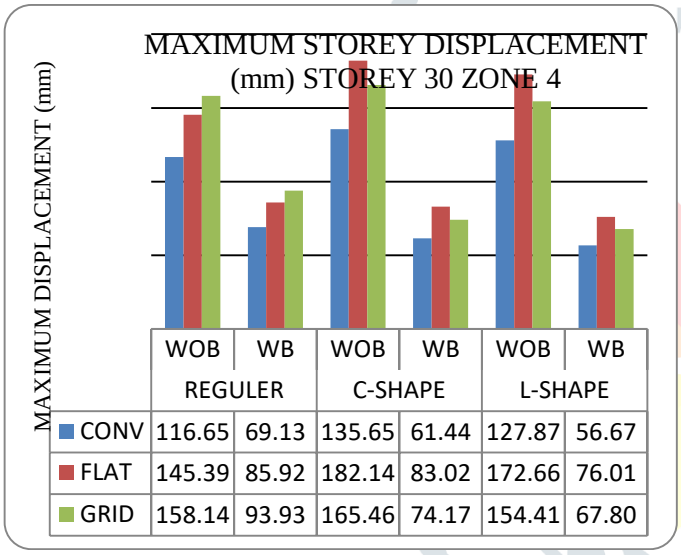


Fig: 4 Maximum Storey Displacement 25 Storey (Zone IV & Zone V)



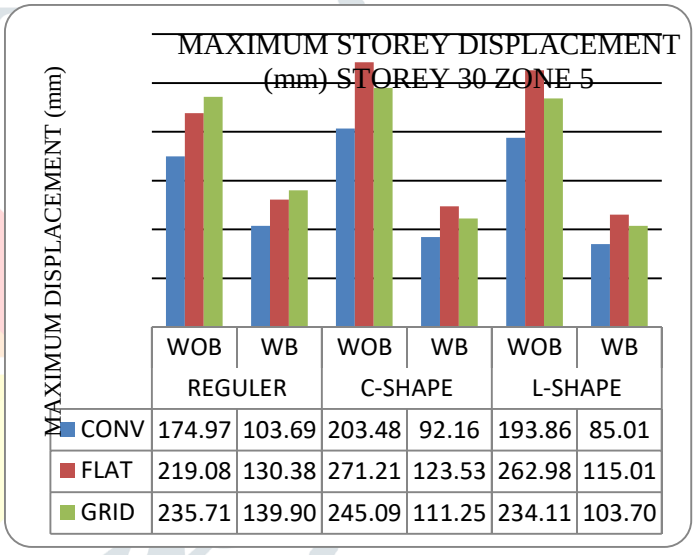
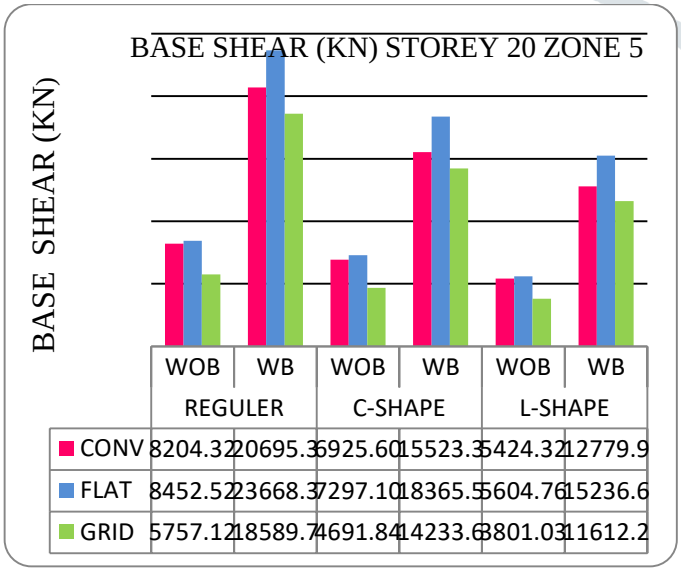


Fig: 5 Maximum Storey Displacement 30 Storey (Zone IV & Zone V)

- **Base Shear:**



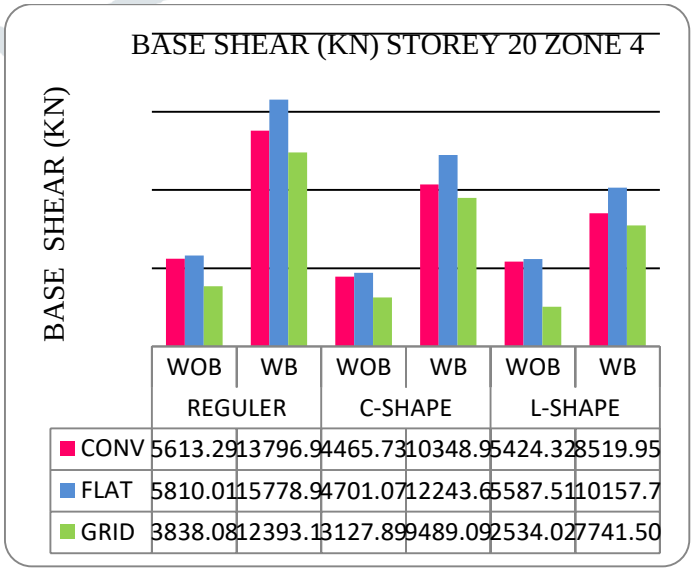
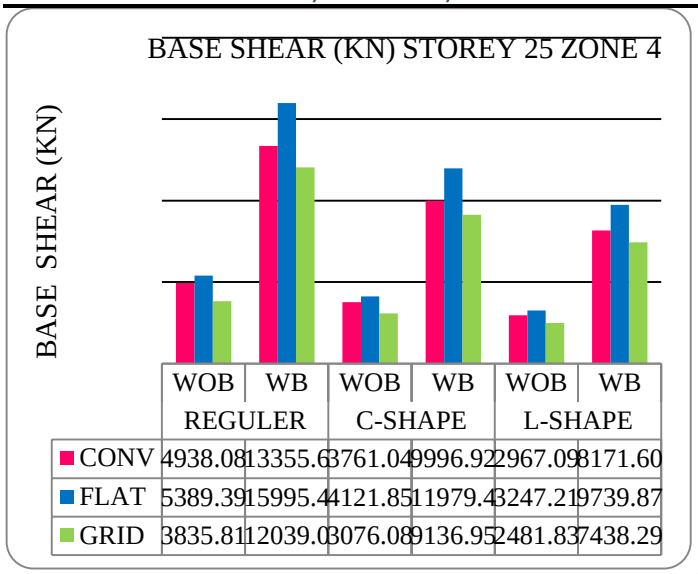


Fig: 6 Base Shear 20 Storey (Zone IV & Zone V)



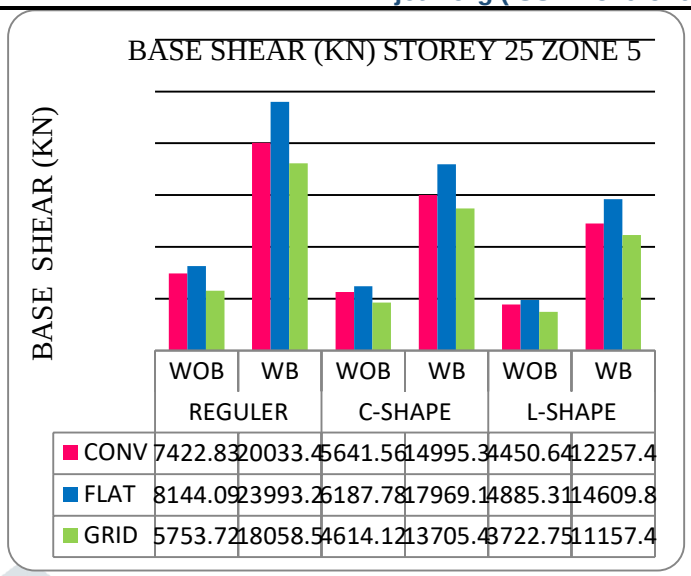
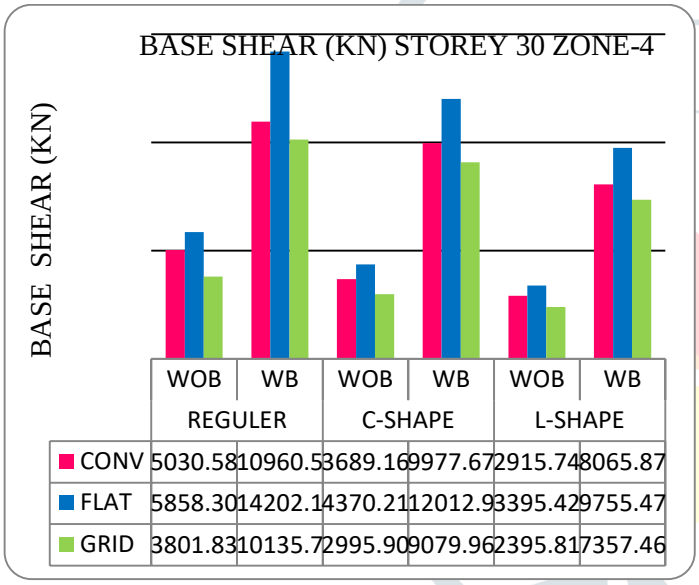


Fig: 7 Base Shear 25 Storey (Zone IV & Zone V)



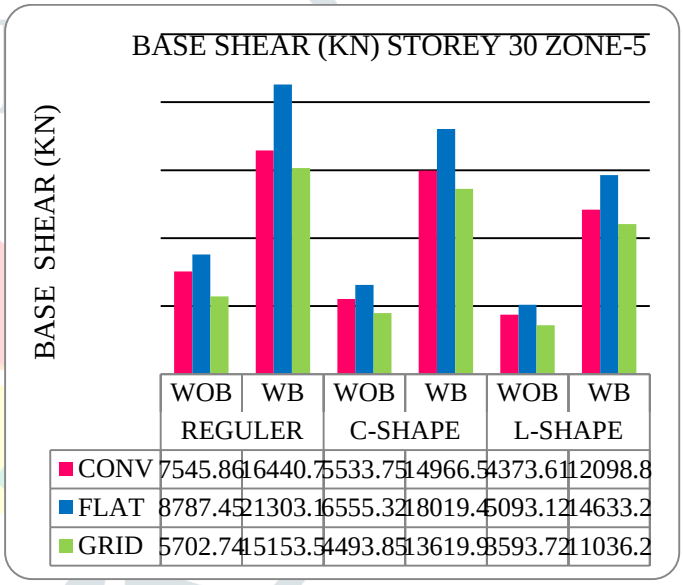


Fig: 8 Base Shear 30 Storey (Zone IV & Zone V)

VI. CONCLUSIONS:

- Displacement for Response spectrum analysis varies up-to 17.33%, 20.22% and 25.21% for 20, 25 and 30 storey respectively for Flat slab without Bracing compared to Conventional slab.
- Displacement for Response spectrum analysis varies up-to 16.20%, 19.07% and 25.73% for 20, 25 and 30 storey respectively for Flat slab with Bracing compared to Conventional slab.
- Displacement for Response spectrum analysis varies up-to 28.41%, 31.32% and 34.71% for 20, 25 and 30 storey respectively for Grid slab without Bracing compared to Conventional slab.
- Displacement for Response spectrum analysis varies up-to 28.09%, 31.21% and 34.91% for 20, 25 and 30 storey respectively for Grid slab with Bracing compare to Conventional slab.
- Displacement for Response spectrum analysis varies up-to 24.60%, 29.69% and 33.28% for 20, 25 and 30 storey respectively for Flat slab without Bracing Compared to Conventional slab in C-shape building.
- Displacement for Response spectrum analysis varies up-to 23.18%, 30.05% and 34.04% for 20, 25 and 30 storey respectively for Flat slab with Bracing compare to Conventional slab in C-shape building.
- Displacement for Response spectrum analysis varies up-to 14.49%, 20.94% and 20.45% for 20, 25 and 30 storey respectively for Grid slab without Bracing compare to Conventional slab in C-shape building.
- Displacement for Response spectrum analysis varies up-to 11.29%, 15.47% and 20.71% for 20, 25 and 30 storey respectively for Grid slab with Bracing compare to Conventional slab in C-shape building.
- Displacement for Response spectrum analysis varies up-to 24.15%, 29.63% and 35.65% for 20, 25 and 30 storey respectively for Flat slab without Bracing compare to Conventional slab in L-shape building.
- Displacement for Response spectrum analysis varies up-to 25.35%, 30.60% and 35.29% for 20, 25 and 30 storey respectively for Flat slab with Bracing compare to Conventional slab in L-shape building.
- Displacement for Response spectrum analysis varies up-to 15.27%, 20.74% and 20.76% for 20, 25 and 30 storey respectively for Grid slab without Bracing compare to Conventional slab in L-shape building.
- Displacement for Response spectrum analysis varies up-to 11.37%, 14.73% and 21.99% for 20, 25 and 30 storey respectively for Grid slab with Bracing compare to Conventional slab in L-shape building.
- Base Shear for Response spectrum analysis is more in flat slab.

- Base Shear for Response spectrum analysis is more in rectangular shape than C & L-shape building.
- Base Shear for Response spectrum analysis is more in Bracing compare to without Bracing.

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