

# Study the behaviour of Flat, Conventional and Grid Slab of R.C.C. Structures for Regular & Irregular in Plan with & without Shear wall

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**Abstract:** Recently there has been a considerable increase in the number of unsymmetrical buildings in plan, both residential and commercial. The slab may be supported directly on walls, 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 of multi-storey buildings having Flat slabs, Grid Slab and Conventional slab system for G+9, G+14 and G+19 with various plan irregularities, with and without shear wall 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, Shear wall, C-shape, Response spectrum, ETABS 2016.**

## I. INTRODUCTION

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 loads, that is live load, dead load, superimposed load, and lateral loads are such as seismic load and wind load.

Generally, there are so many types of slab but here will discuss about three different types of slabs that is Flat slab, Conventional Slab & Grid slab. **Flat slab** is a reinforced concrete element supported directly on concrete columns or on the drop panels used above the columns. There are no beams in a flat slab. **Conventional slabs** are generally rectangular in shape, but they also occur any irregular shape such as triangular, circular, trapezoidal etc. **Grid slabs** consist of intersecting beams at consistent intervals in both direction and its monolithically slab.

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

Irregular buildings 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 structure under seismic load.
- ✚ To analysis the different slab system with Rectangular and C-shape (plan irregularity).
- ✚ To analysis the slab with different height of structure. (G+9, G+14 and G+19)
- ✚ To analysis the structure with and without shear wall.

## III. LITERATURE REVIEW

<sup>10</sup>Salman I. Khan and Ashok R. Mundhada investigated that Base shear of flat slab building is more than that of the grid slab building. The difference between the two varies from 3-4(%). In comparison of the grid slab building and flat slab building, the time period is more for flat slab building than that of grid slab building. The difference between the two is about 23(%).

<sup>6</sup>Mr. Tejas B, Mr. Raghu M E, investigated that decreasing in spacing of grid, increases the load carrying capacity of the building. The storey displacement for grid slab with zone VI seismic intensity has a lesser displacement value.

<sup>5</sup>Mohammed Fatir, M.H. Kolhar, investigated that the drift value in zone IV is more compare to zone III for all the different types of buildings. The structure with shear wall having 13% to 15% less drift value in compare with the bracing structure.

<sup>7</sup>Navjot Kaur Bhatia and Tushar Golait investigated that the performance and structural characteristics of Flat Slabs & Grid Floors are superior to conventional slabs.

## IV. METHODOLOGY

In the present work the analysis of following structures with different type of slabs are been carried out:

- a) Flat Slab System
- b) Conventional Slab System
- c) Grid Slab System

The plan areas of the all three structures are different for the analysis; also, the beam and column dimensions are kept constant. 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 buildings. The steps are followed for the analysis purpose, the below are the two steps which carry out the whole analysis and description of the procedure:

## Step -1 Response Spectrum Analysis

**a) Regular Building Rectangular in Plan with shear wall (WS) and without Shear wall (WOS)**

- i) 10 Storey Building
- ii) 15 Storey Building
- iii) 20 Storey Building

**b) Irregular Building C-Shaped in Plan with shear wall (WS) and without Shear wall (WOS)**

- i) 10 Storey Building
- ii) 15 Storey Building
- iii) 20 Storey Building

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

- The dynamic analysis of the regular as well as irregular (Plan) structure with and without shear wall with different type of slabs should be carried out.
- The both structures should be analysed according to the different seismic zones (IV and V).
- The result parameter includes the Base Shear, Displacement, Drift and Time Period which are to be compared.

✚ **Structure and Section details:**

Plan dimension (Rectangular shape)	42m * 25m
Plan dimension (C-shaped 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
Shear wall thickness	230mm
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	750 mm * 750 mm
Slab thickness	Conventional – 150 mm, Flat – 200 mm Grid – 100 mm
Panel size	6 m * 5 m
Dead load	Default values taken by E-Tabs
Live load	4 KN/m <sup>2</sup>
Floor finish	1.5kN/m <sup>2</sup>
Wall load	13.86 kN/m
Importance Factor (I)	1
Response Reduction Factor (R)	5

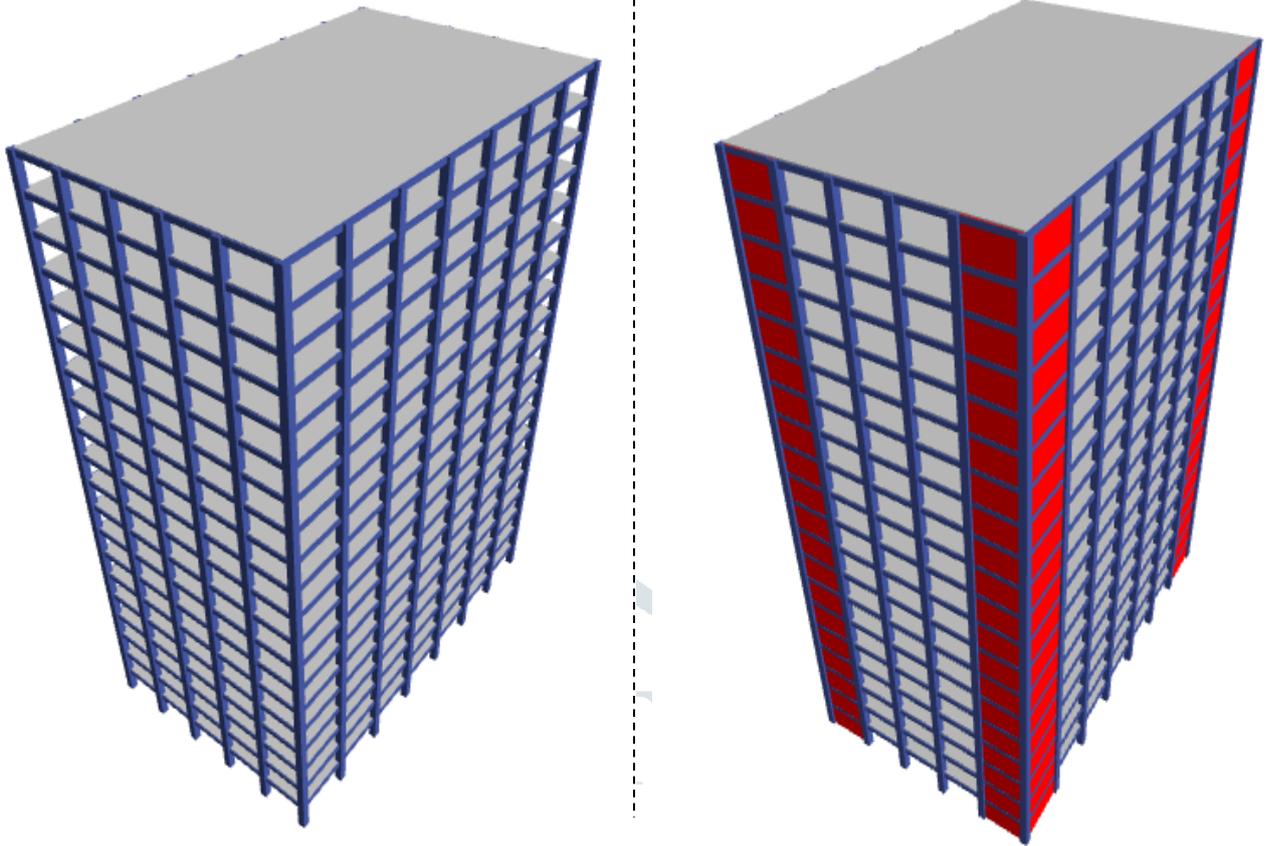


Fig:1 Rectangular in plan with & without shear wall

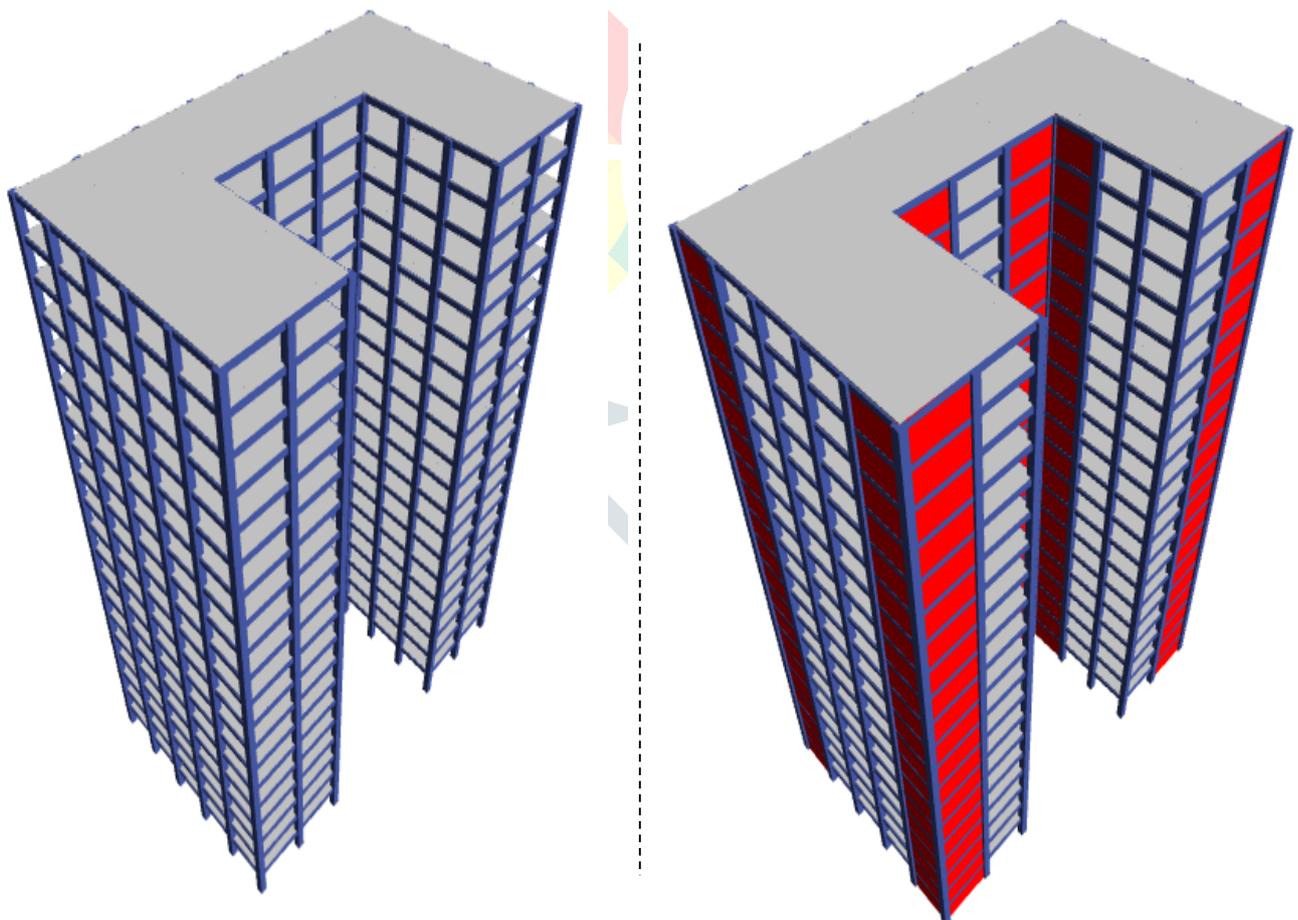
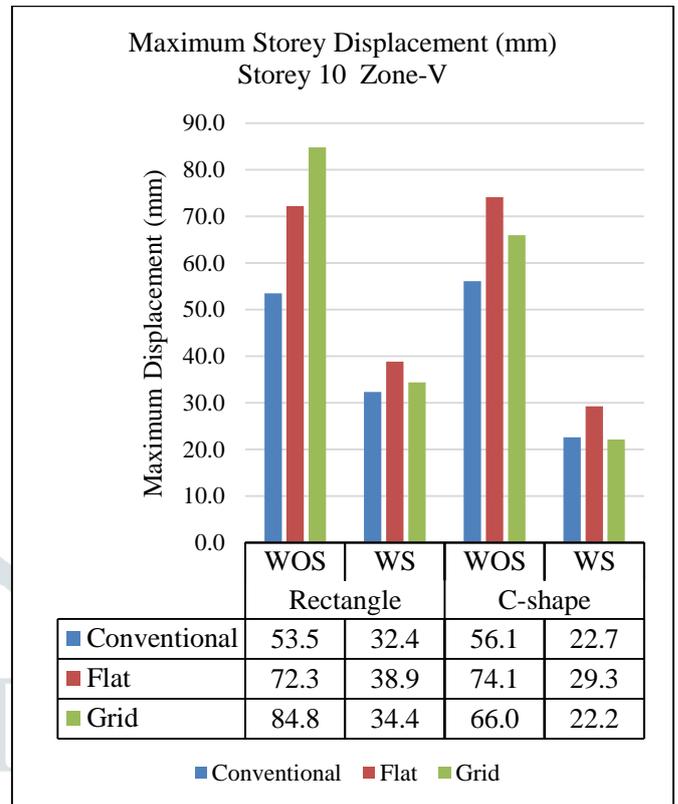
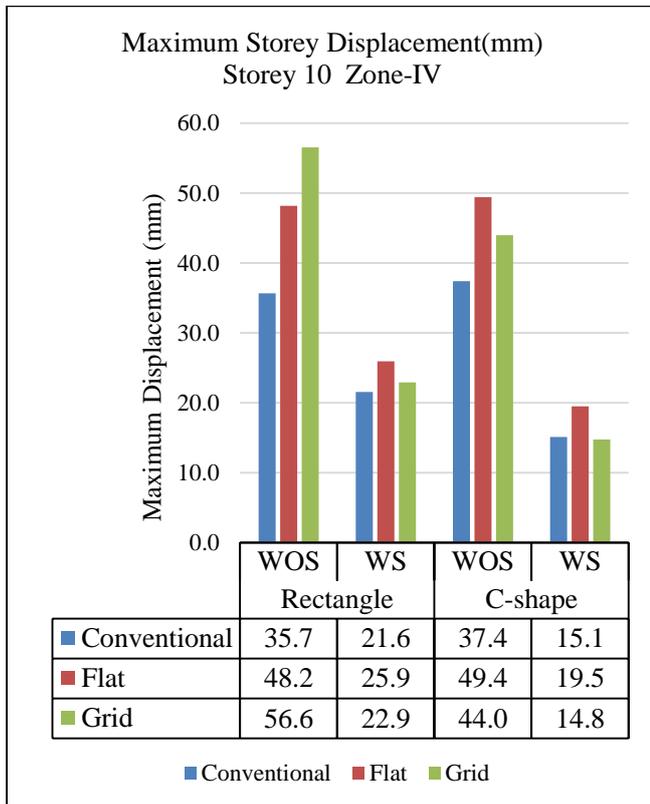


Fig:2 C-shaped in plan with & without shear wall

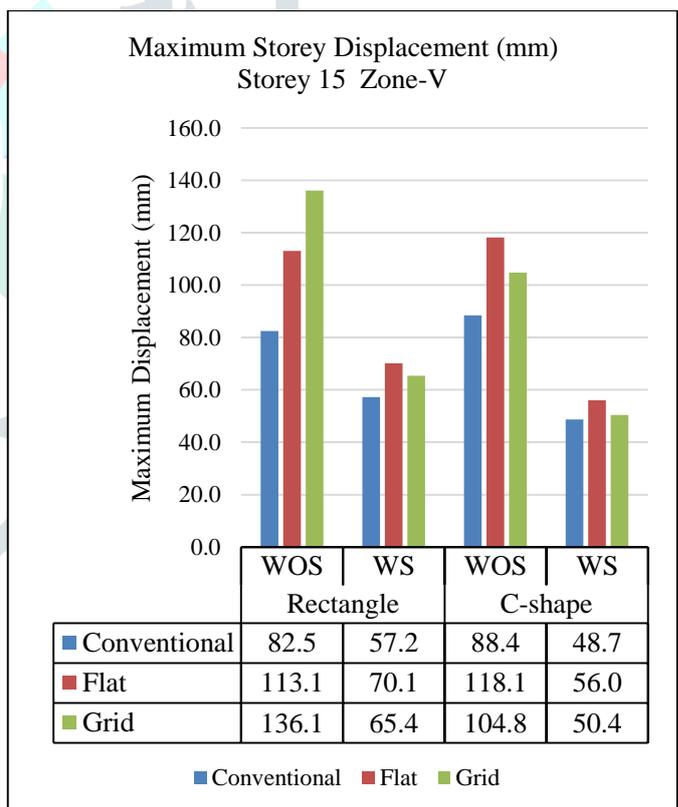
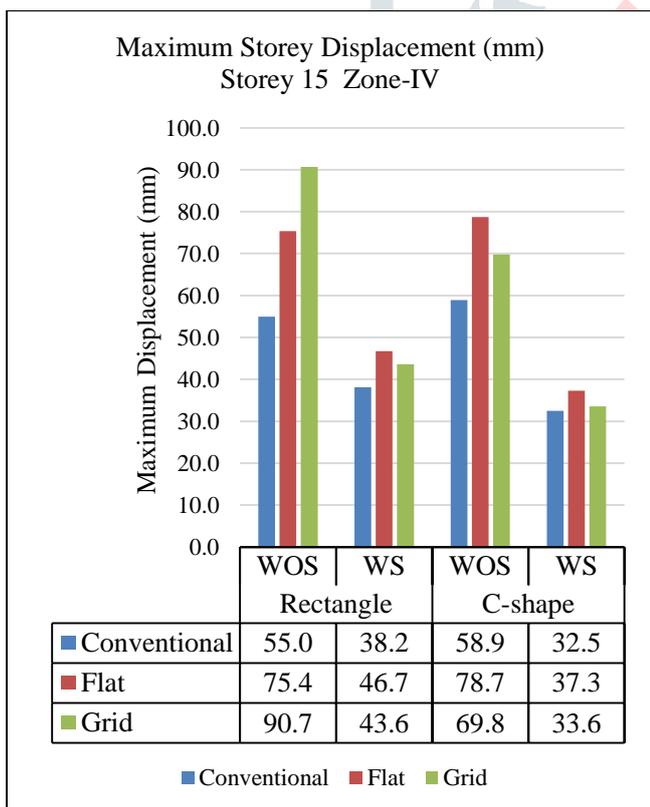
## V. RESULTS

The analysis results of multi storey building with Conventional, Flat and Grid slab subjected to seismic forces in Zone IV and V are as below of with shear wall (WS) and without shear wall (WOS) having rectangular and C-shape structure.

✚ **Maximum Storey Displacement:**



**Fig:3 Maximum Storey Displacement 10 Storey (Zone IV & Zone V)**



**Fig:4 Maximum Storey Displacement 15 Storey (Zone IV & Zone V)**

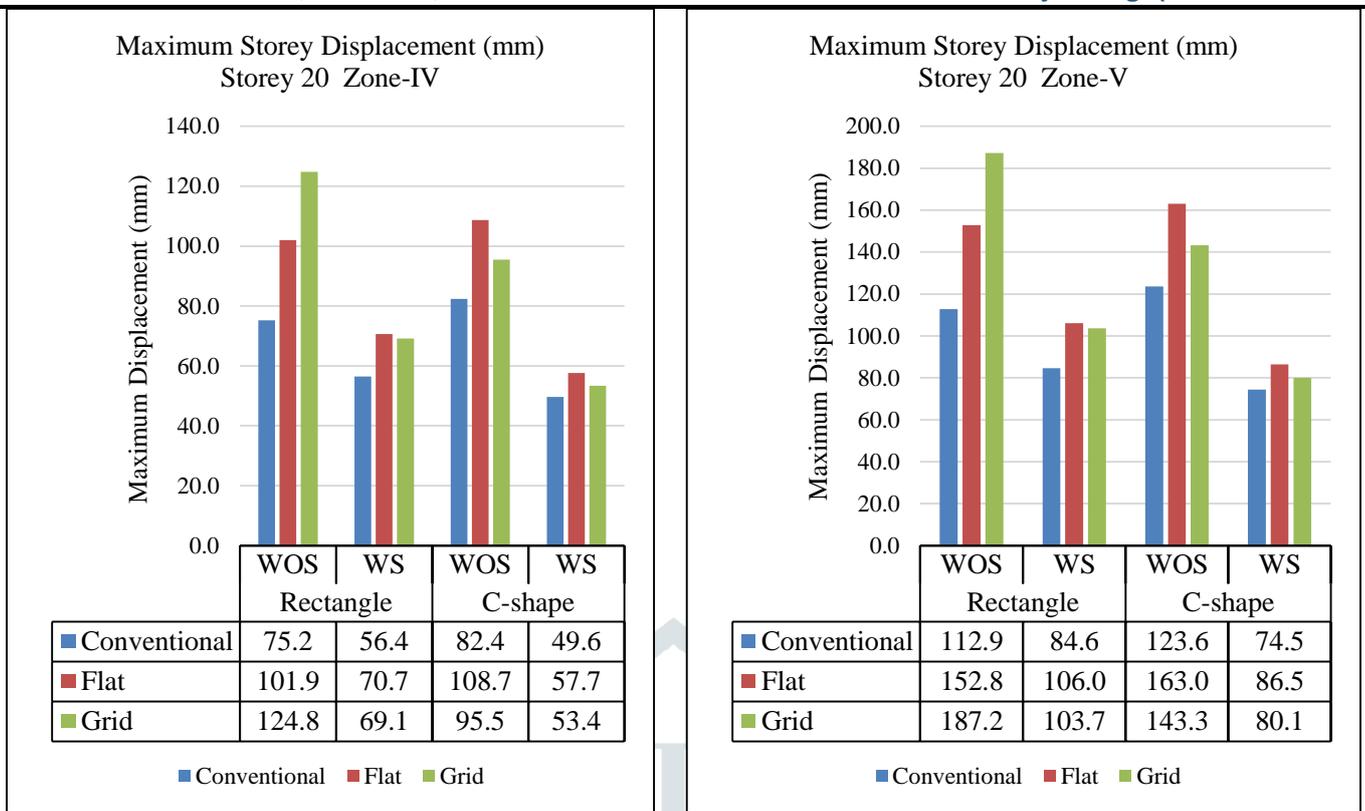


Fig:5 Maximum Storey Displacement 20 Storey (Zone IV & Zone V)

**Base Shear:**

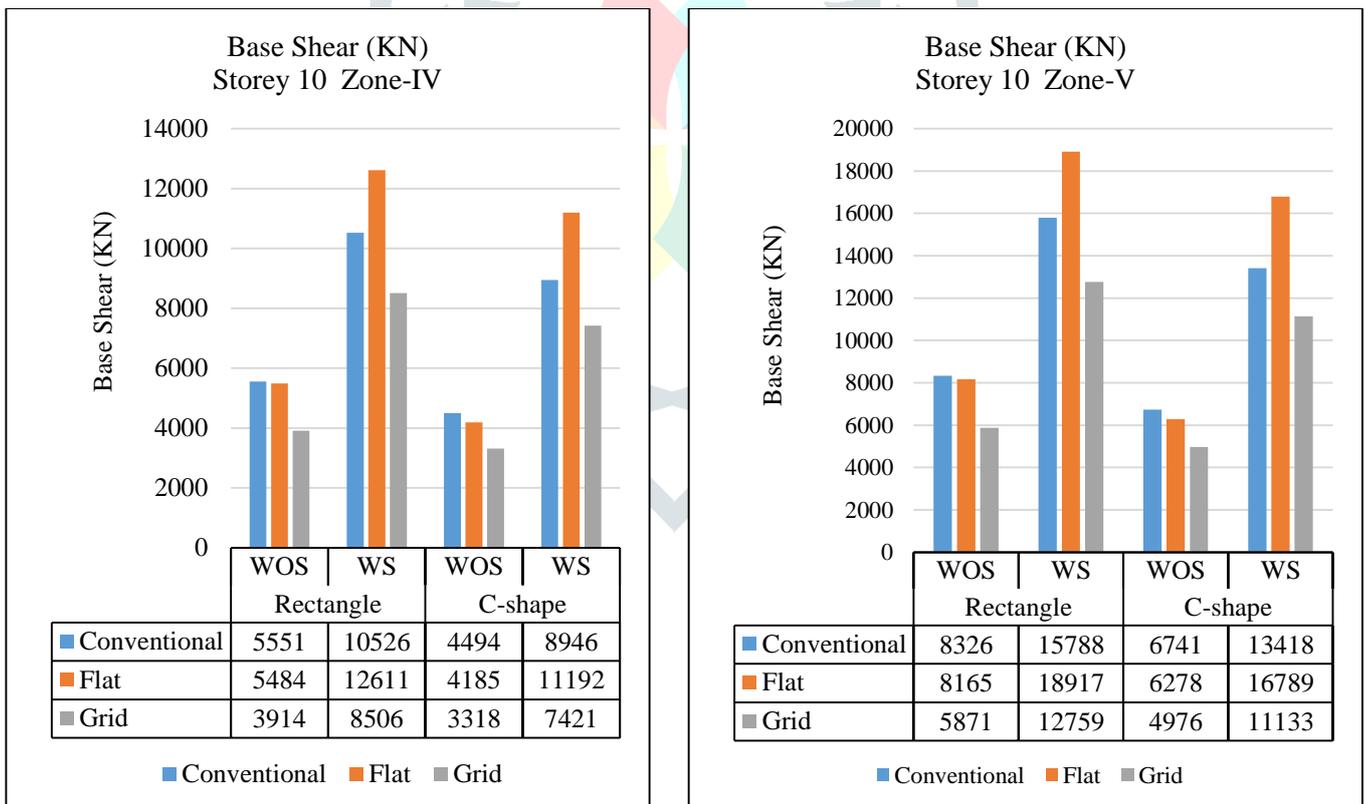


Fig:6 Base Shear 10 Storey (Zone IV & Zone V)

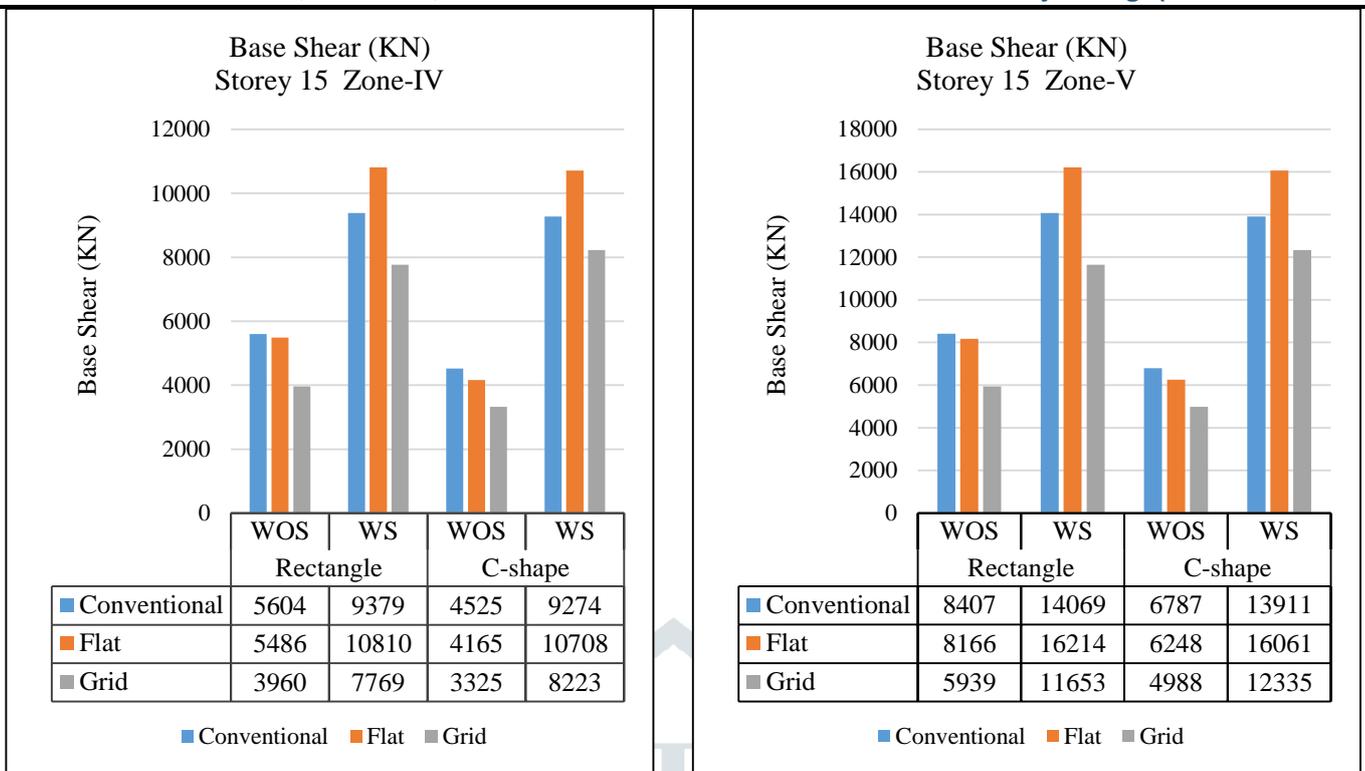


Fig:7 Base Shear 15 Storey (Zone IV & Zone V)

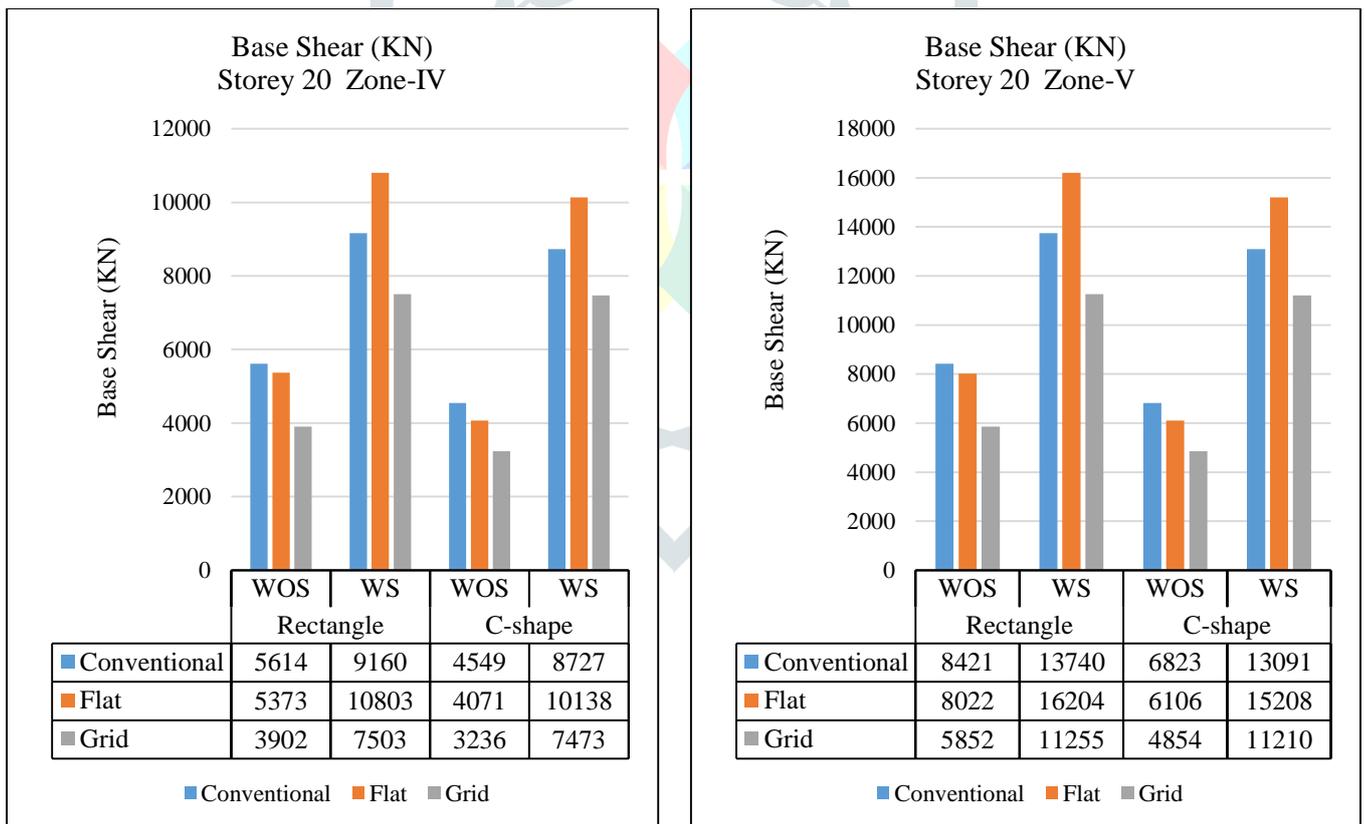


Fig:8 Base Shear 20 Storey (Zone IV & Zone V)

**VI. CONCLUSIONS:**

- ✚ Displacement for Response spectrum analysis varies up-to 35.02, 37.08 and 35.49% for 10, 15 and 20 story respectively for Flat slab without Shear wall compared to Conventional slab
- ✚ Displacement for Response spectrum analysis varies up-to 20.21, 22.51 and 25.28% for 10, 15 and 20 story respectively for Flat slab with Shear wall compared to Conventional slab
- ✚ Displacement for Response spectrum analysis varies up-to 58.55, 64.98 and 65.88% for 10, 15 and 20 story respectively for Grid slab without Shear wall compared to Conventional slab.
- ✚ Displacement for Response spectrum analysis varies up-to 6.32, 14.24 and 22.49% for 10, 15 and 20 story respectively for Grid slab with Shear wall compared to Conventional slab.
- ✚ Displacement for Response spectrum analysis varies up-to 32.09, 33.61 and 31.95% for 10, 15 and 20 story respectively for Flat slab without Shear wall compared to Conventional slab in C-shape building.
- ✚ Displacement for Response spectrum analysis varies up-to 29.20, 14.95 and 16.15% for 10, 15 and 20 story respectively for Flat slab with Shear wall compared to Conventional slab in C-shape building.
- ✚ Displacement for Response spectrum analysis varies up-to 17.58, 18.52 and 15.94% for 10, 15 and 20 story respectively for Grid slab without Shear wall compared to Conventional slab in C-shape building.
- ✚ Displacement for Response spectrum analysis varies up-to 2.22, 3.44 and 7.52% for 10, 15 and 20 story respectively for Grid slab with Shear wall compared to Conventional slab in C-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-shape building.
- ✚ Base Shear for Response spectrum analysis is more in shear wall compared to without shear wall.

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