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The Wind and Seismic Analysis on Different Heights of Building by Using ETABS

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Abstract - **High rise buildings become common in the modern growing cities as the height of the building increase for the given width, the building frame becomes more flexible particularly in the case of frames with heights above 15 stories slenderness becomes more and fundamental frequency of the frames becomes less. The wind pressures are fluctuating the nature and this is illustrated by the wind spectrum. In the present project a building with different heights is analyzed for wind as well as for earthquake loads for different load combinations. Considering a building with height of 20m, 30m, 40m, 50m, 60m in worst condition i.e,, in ZONE-II,III,IV and SOIL-3 and analyzed for load combinations 1.2(DL+LL+LATERAL LOAD) in X direction with lateral load resisting systems. Results of displacement, storey shear, moment are compared for load combinations in both static & dynamic analysis. Results are tabulated and a optimum solution is concluded.**
Keywords: **Winfd and Seismic, ETABS**

I. INTRODUCTION

All over the world bracing system has been considered as the most efficient measure against the lateral loads induced in the building due to the seismic forces. This paper aims at providing an efficient bracing system against such forces. In order to increase the stiffness of the columns and to reduce their net longitudinal reinforcement decreasing their effective length can be a good solution but the challenge is to how can we do so without changing the general building specifications(specially architectural) and not disturbing the basic building frame structure as a whole.

A. Use of Bracing System in Decreasing the Effective Length of the Column

A new bracing system shaped like a diamond is incorporated in the main building frame and its applicability is evaluated by detailed calculations. It is also compared with the other known bracing system known as the cross bracing system. Both the bracing system has been shown below.

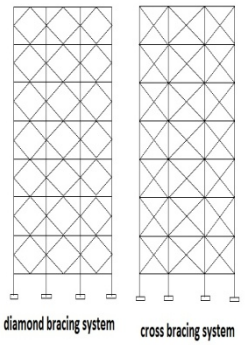

Fig.1 Showing Different Types Of Bracings

Bracing is a very effective global upgrading strategy to enhance the global stiffness and strength of steel and composite frames. It can increase the energy absorption of structures and/or decrease the demand imposed by earthquake loads. Structures with augmented energy dissipation may safely resist forces and deformations caused by strong ground motions. Generally, global modifications to the structural system are conceived such that the design demands, often denoted by target displacement, on the existing structural and non-structural components, are less than their capacities (Figure 1). Lower demands may reduce the risk of brittle failures in the structure and/or avoid the interruption of its functionality. The attainment of global structural ductility is achieved within the design capacity by forcing inelasticity to occur within dissipative zones and ensuring that all other members and connections behave linearly.

II. BUILDING DIMENSIONS

The building is 18m x 18m in plan with columns spaced at 6m from center to center. A floor to floor height of 3.0m is assumed. The location of the building is assumed to be at zone-11,111,1V& soil-3.

Column Sizes & Beam Sizes for 20m Height Building

Column size : 450mm X 650 mm

Beam size : 350mm X 450 mm

Column Sizes & Beam Sizes for 30m Height Building

Column size : 500mm X 650 mm

Beam size : 400mm X 450 mm

Column Sizes & Beam Sizes for 40m Height Building

Column size : 550mm X 700 mm

Beam size : 450mm X 550 mm

Column Sizes & Beam Sizes for 50m Height Building

Column size : 600mm X 750 mm

Beam size : 450mm X 600 mm

Column Sizes & Beam Sizes for 60m Height Building

Column size : 600mm X 900 mm

Beam size : 500mm X 600 mm

Bracing size:230mmx230mm,

Slab thickness: 120mm,

Live load: 2KN

Floor Finish: 1KN

Mix proportion: M30

Grade of steel : Fe 500

Load Combination: (DL+LL+EQX+WIND X) 1.2

Dead load - 1.2

Live load - 1.2

EQX - 1.2

WIND X -1.2

Windward Coefficient : 0.8

Leeward coefficient : 0.5

A. Load Cases

1.Live Load

Live load is assumed as per IS 875(part 2-imposed loads) table 1. the building is analysed by assuming it to be a residential building the live load was taken as 2KN/m^2

Earth Quake Load

Earth Quake load in this analysis is accordance to IS 1893(part 1)-2002. The buildings models are prepared in all seismic zones i.e. in Z2, Z3, Z4 and Z5. Therefore the value of Z is taken as 0.1, 0.16, 0.24 and 0.36 respectively. And the models are made in all types of soils i.e., Hard/ Rocky (Type I), Medium soil (Type II) and in Loose soil (Type III).

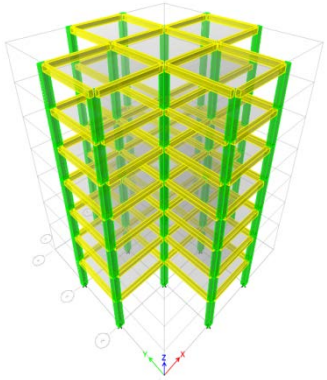

Fig 2.1Showing 3D view of 20m height building

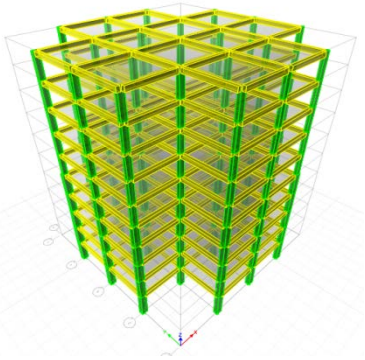

Fig.2.2 Showing 3D View Of 30m

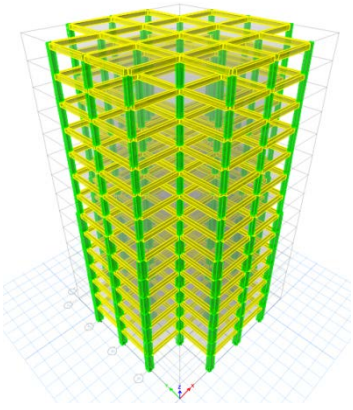

Fig 2.3 Showing 3d View Of 50m Height Building

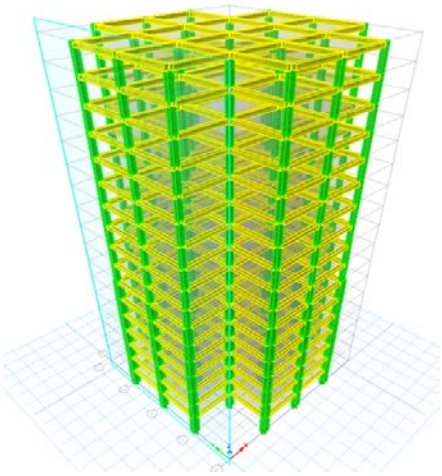

Fig 2.4 Showing 3D view of 40m height building

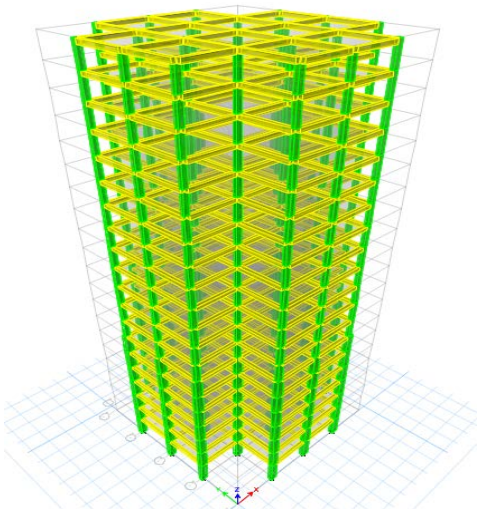

Fig.2.5 Showing 3D view of 60m height building

III. TEST RESULTS AND DISCUSSION

Displacement comparison in zone2, zone3, zone4 along soil-3 for 20m, 30m, 40m, 50m, 60m height building in static analysis.

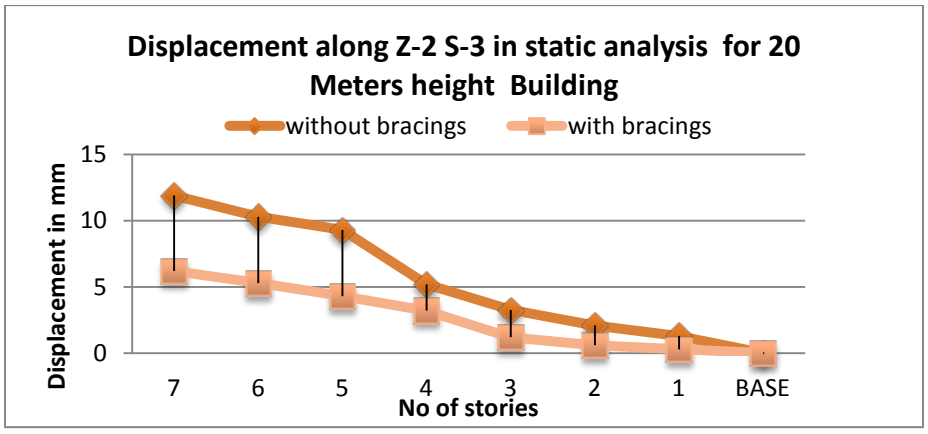

Fig.3.1 Displacement variation of 20m height building in Zone-2 Soil-3 in Static Analysis.

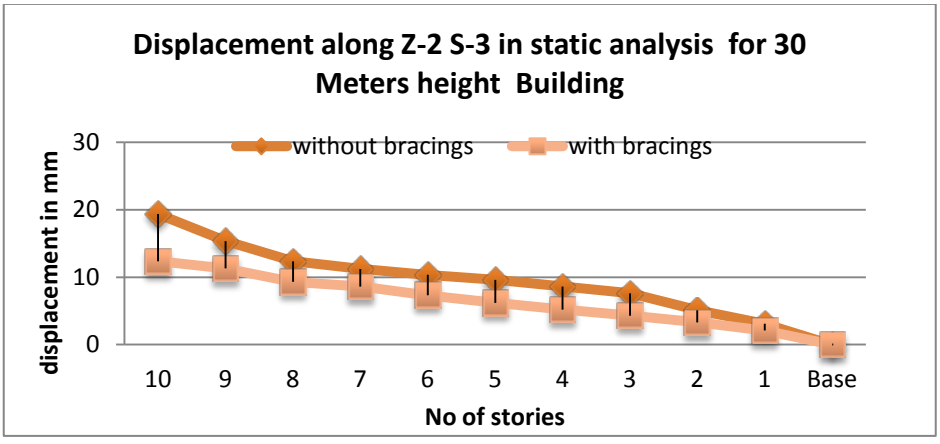

Fig.3.2 Displacement variation of 30m height building in Zone-2 Soil-3 in Static Analysis.

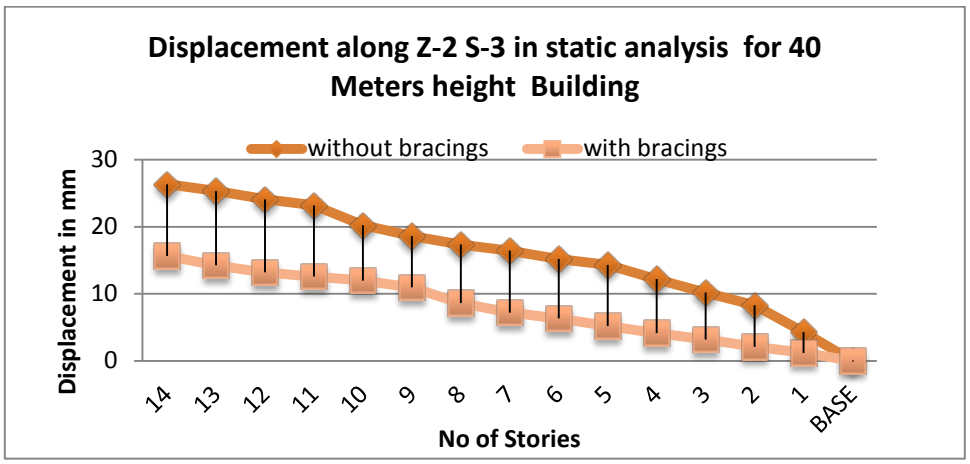

Fig.3.3Displacement variation of 40m height building in Zone-2 Soil-3 in Static Analysis

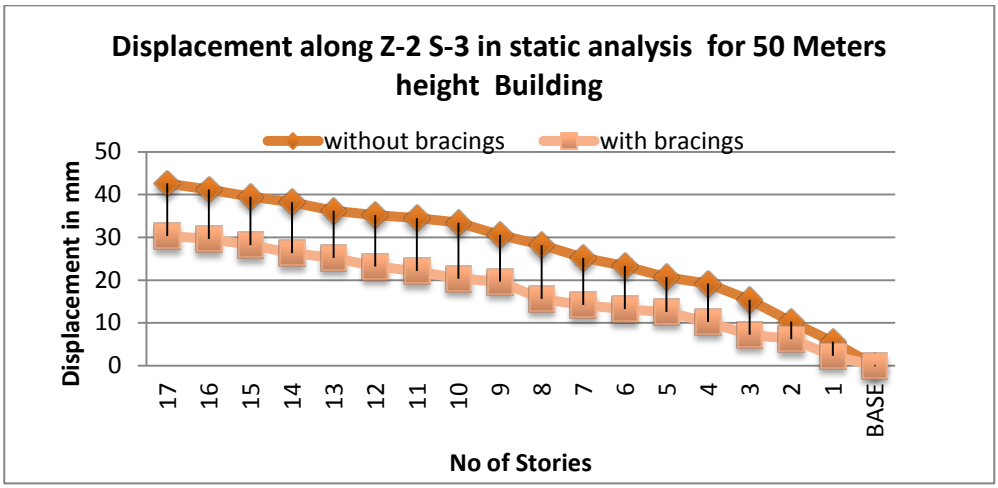

Fig. 3.4Displacement variation of 50m height building in Zone-2 Soil-3 in Static Analysis

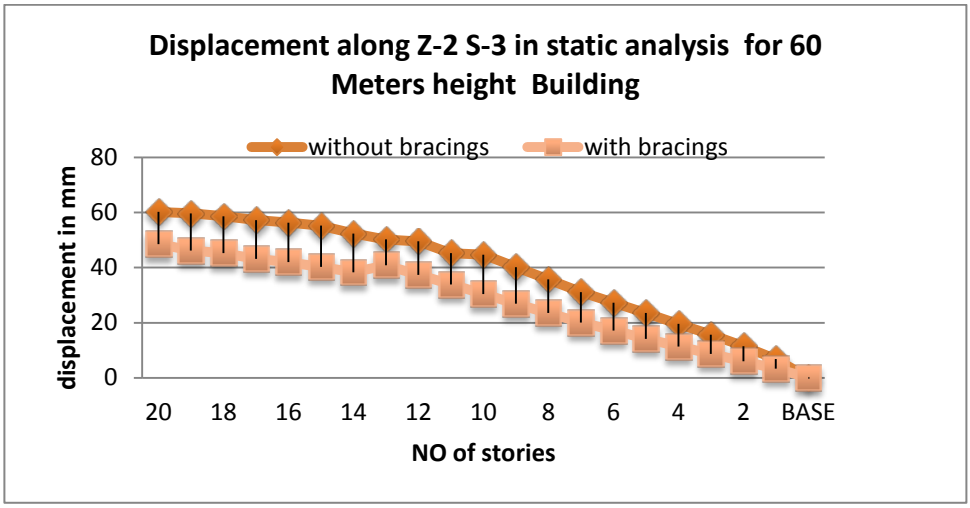

Fig. 3.5 Displacement variation of 60m height building in Zone-2 Soil-3 in Static Analysis

TABLE 1 COMPARATIVE VALUES OF DISPLACEMENT OF DIFFERENT HEIGHTS OF HIGH RISE BUILDING IN ZONE-2 SOIL-3 IN STATIC ANALYSIS.

Displacement		
ZONE-2 SOIL-3		
Building height	**Without**	**With bracings**
20	11.9	6.2
30	19.36	12.36
40	26.36	15.66
50	42.6	30.3
60	60.2	48.56

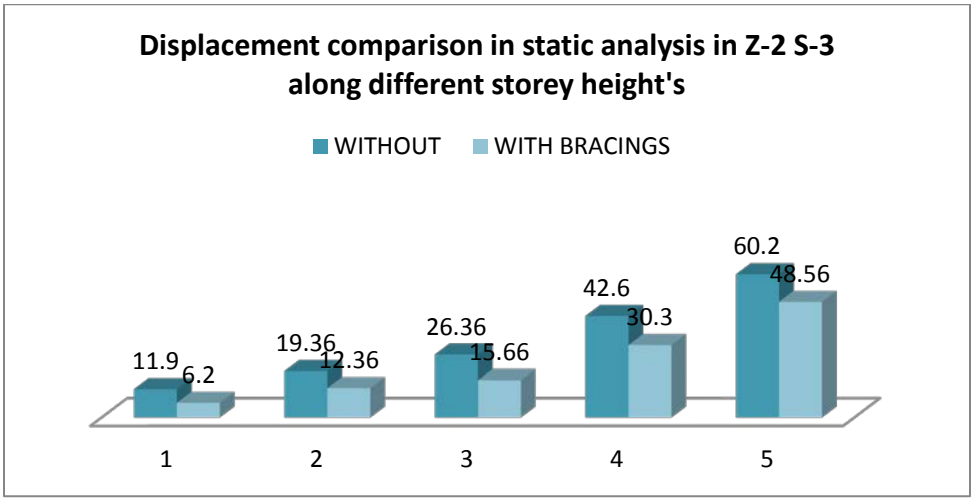

Fig.3.6 Displacement variation of different heights of high rise building in Zone-2 Soil-3 in Static Analysis.

Displacement comparison in zone2, zone3, zone4 along soil-3 for 20m, 30m, 40m, 50m, 60m height building in dynamic analysis.

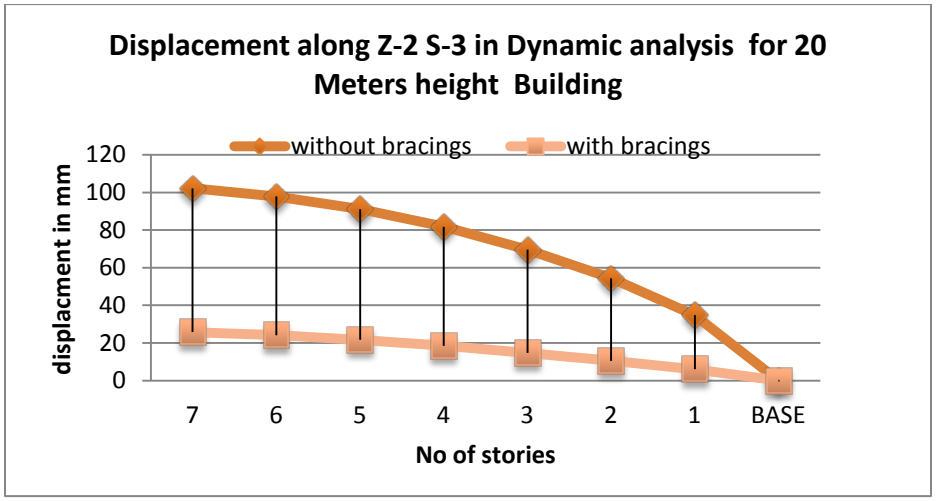

Fig.3.7 Displacement variation of 20m height building in Zone-2 Soil-3 in dynamic Analysis.

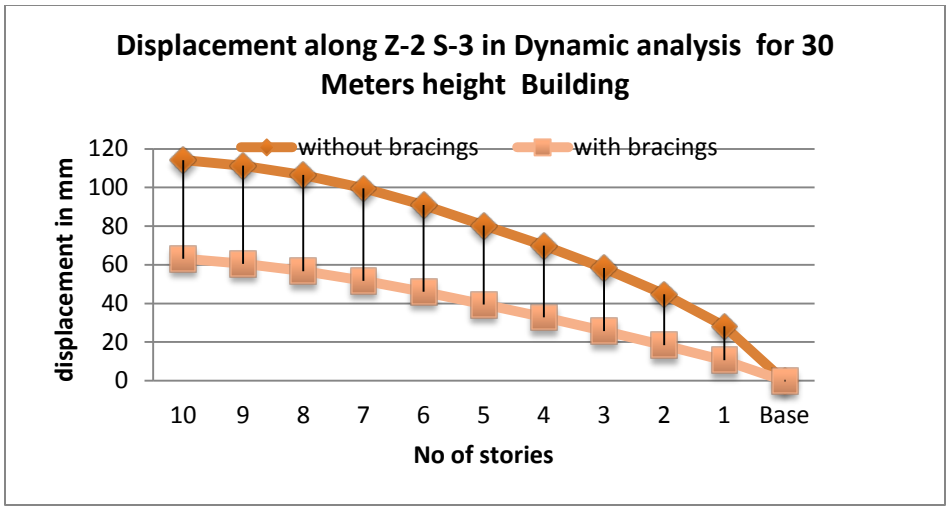

Fig.3.8 Displacement variation of 30m height building in Zone-2 Soil-3 in dynamic Analysis.

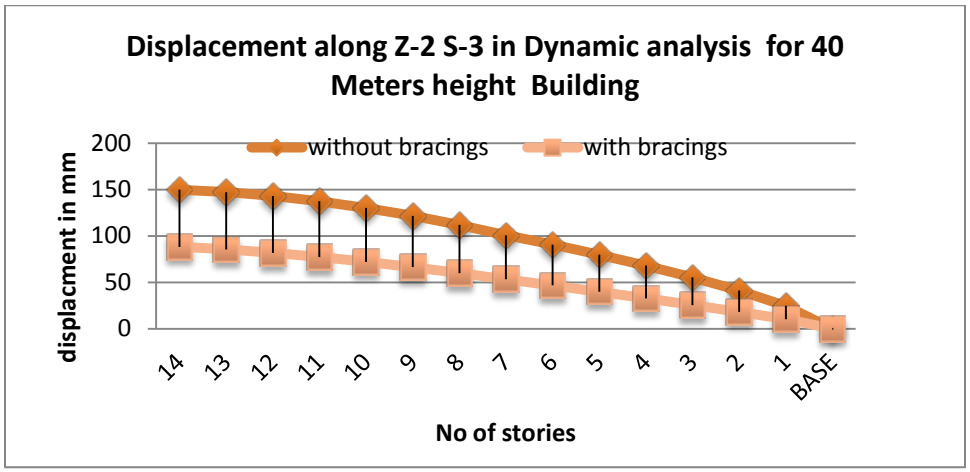

Fig.3.9 Displacement variation of 40m height building in Zone-2 Soil-3 in dynamic Analysis.

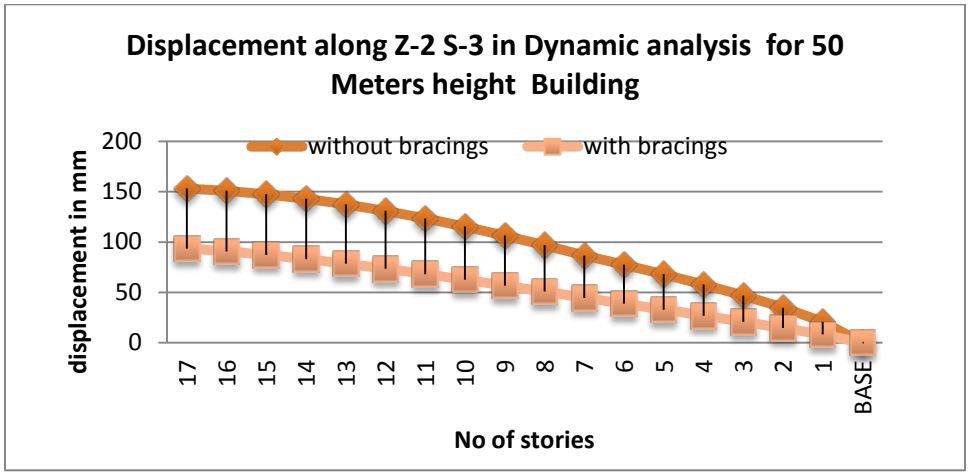

Fig.3.10 Displacement variation of 50m height building in Zone-2 Soil-3 in dynamic Analysis.

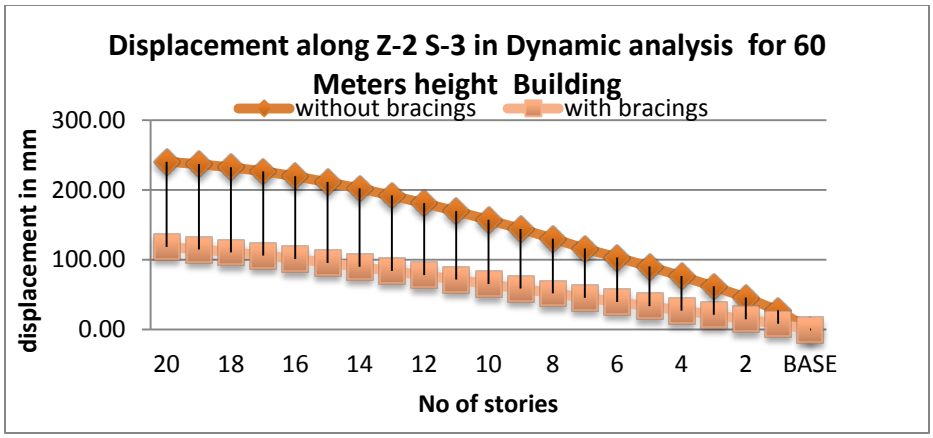

Fig.3.11 Displacement variation of 60m height building in Zone-2 Soil-3 in dynamic Analysis.

TABLE 2 COMPARATIVE VALUES OF DISPLACEMENT OF DIFFERENT HEIGHTS OF HIGH RISE BUILDING IN ZONE-2 SOIL-3 IN STATIC ANALYSIS.

Displacement		
ZONE-2 SOIL-3		
Building Height	**Without**	**With Bracings**
20	102.2	25.7
30	114.2	63.2
40	150	88.3
50	153.2	93.6
60	240.5	118.3

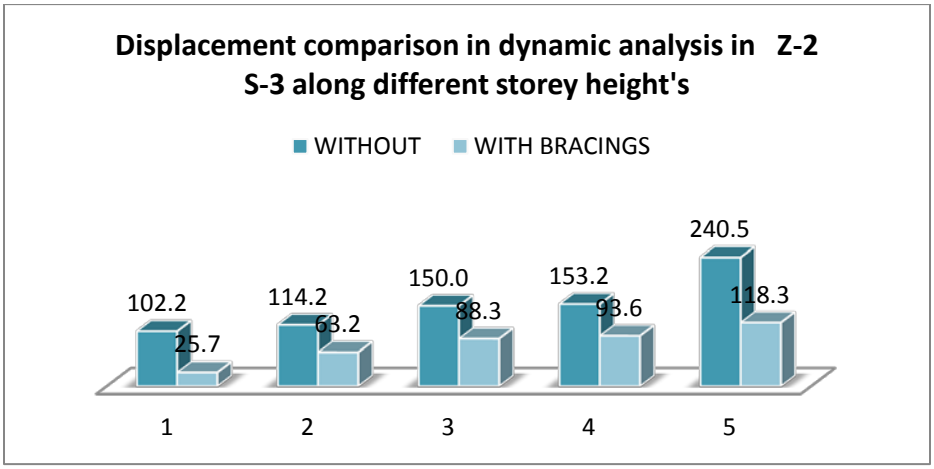

Fig.3.12 Displacement variation of different heights of high rise building in Zone-2 Soil-3 in Static Analysis.

In the present work a high rise building with different heights i.e 20m, 30m, 40m, 50m, 60m is analysed in zone2 in three different soils and the results of Displacement, is taken in both static(1.2(DL+LL+EQX+WINDX) and dynamic (Response Spectrum) analysis and a conclusion is made based on this work. And a brief discussion of each results is explained below.

A. Variation of Displacement for Different Zones & Soils in Static Analysis

In this case the reduction of Displacement is observed when the lateral systems i.e. when bracings are provided under static load for different heights of building i.e,, 20m, 30m, 40m, 50m, 60m. The displacement for different heights of building is compared in Zone2, Zone3, Zone4 in soil-3 i.e. zone factor on X axis & displacement on Y axis, from Graphs is to be noted that displacement of 30% - 45% is reduced.

B. Variation of Displacement for different zones & soils in Dynamic analysis

In this case the reduction of Displacement is observed when the lateral systems i.e. when bracings are provided under dynamic load for different heights of building i.e,, 20m, 30m, 40m, 50m, 60m. The displacement for different heights of building is compared in Zone2, Zone3, Zone4 in soil-3 i.e. zone factor on X axis & displacement on Y axis, from Graphs is to be noted that displacement of 50% - 55% is reduced.

IV. CONCLUSIONS

1. The structural performance is analyzed in different heights of building i.e. Without bracings, With X Bracing, the displacement of 45% is reduced when lateral systems are provided.
2. Dynamic Analysis i.e..Response Spectrum analysis is performed for all the models i.e. without bracings & with bracings. The displacement of 40% is reduced when X bracings are provided.
3. By providing lateral systems in the framed structures the reduction in the displacement, shear, moment thereby increasing the stiffness of the structure for resisting lateral loads due to earth quakes.

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