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Response of Reinforced Concrete Buildings Close To Deep Excavation

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Abstract: **Nowadays in the urban areas people are going deeper into the ground because of insufficient space in urban areas. More space required for parking, basements, library, housing utilities etc. Deep excavation is carried out close to the existing building it may be single story building or multistory building it causes larger settlement, more displacements and bending moment near the deep excavation and also mainly it causes the design fail of foundation area of existing building when the deep excavation carried out close to the existing building .These settlements or displacements are controlled by providing braced wall to the deep excavation. In this analysis 2D finite element of G+10 story modeling considered for the analysis and the response of existing building when the deep excavation carried out at different distances and at different depths are tabulated and compared in the present work.**

Keywords: **Deep excavation, displacements, Finite element analysis, settlements.**

I. INTRODUCTION

An excavation is to be made more than 4.5m in soil or rock is called deep excavation. In urban areas due to insufficient space people are going to deeper excavation to create additional space required to meet increasing the space requirements for amenities, parking and for housing utilities etc. Fig 1 and 2 shows that due to deep excavation it may be for road cutting or for basement etc. , it causes ground movement, wall deflection, larger settlement, displacement etc.

Fig 1 Deep cutting for road

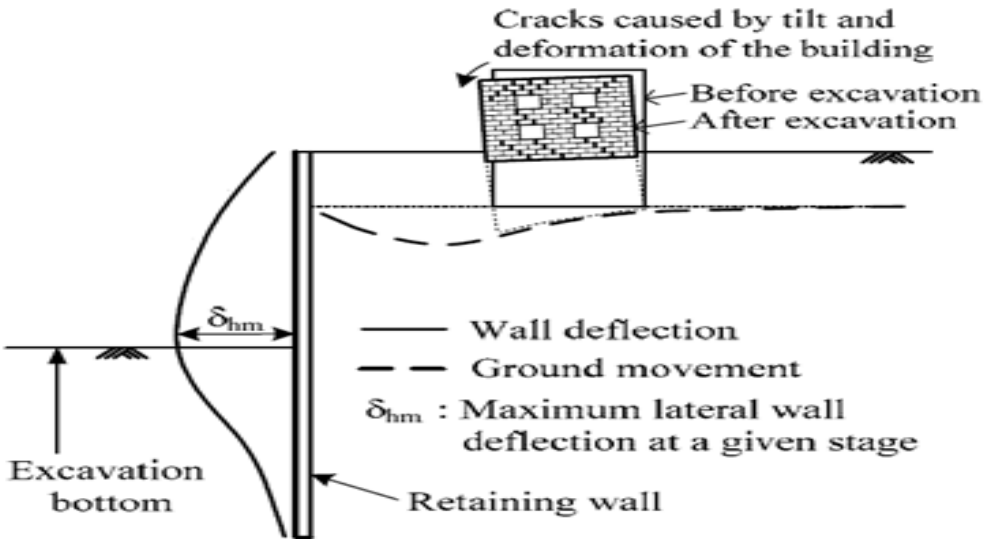

Fig 2: RESPONSE OF STRUCTURE TO DEEP EXCAVATION

II. IMPORTANCE OF THE WORK

Without proper knowledge people are going for deep excavation and it's mainly effects to the adjacent buildings. To avoid this situation it is necessary to provide bracing wall supporting system for the deep excavation. If the excavation for the foundation of the new structure is too close to existing building then in the Terzaghi's bearing capacity equation.

LOST

$$q_{ult} = cN_cs_c + q N_q + 0.5\gamma N\gamma s\gamma$$

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From this Terzhagi's equation due to deep excavation losing of ultimate bearing capacity of the soil takes place and effect of this in turn fail to foundation of the existing structure takes place. Damage of the existing structure depending upon the type of the soil, depth of excavation and also magnitude of ground movement surrounding the excavation.

III. MODELING AND ANALYSIS

In this present work, for the analysis simulation two dimensional finite element SAP 2000 version was used. 2D G+ 10 storeys model is used for the analysis .The grade of concrete for columns and beams are considered as M30. The live load of 3kN/m^2 and the floor finish load of 1kN/m^2 . The cross section of the beams and the columns are assumed as 300x750mm and 750x750 mm for models. Analysis is carried out for 1m distance from the existing building and 6m depth, 2m distance 6m depth and 3m distance and 6m depth as shown in figures 3, 4 and 5.

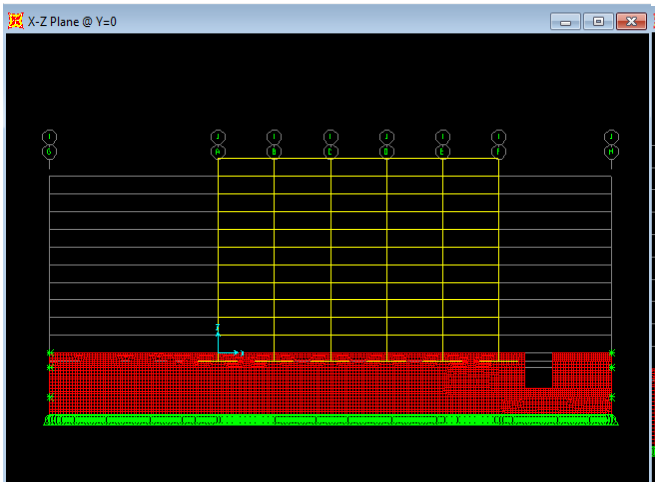

Fig 3: 1m distance and 6m depth

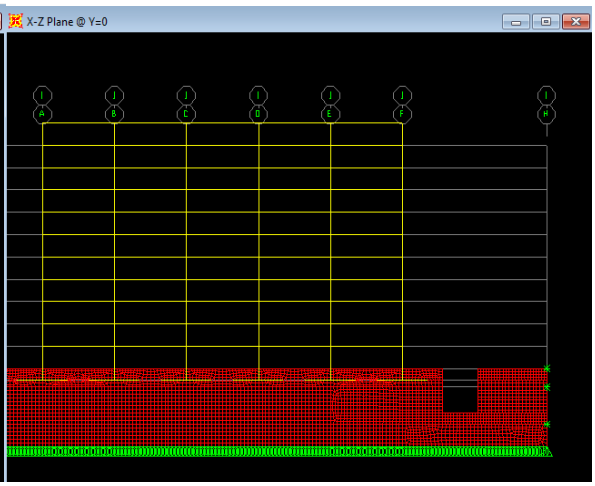

Fig 4: 2m distance and 6m depth

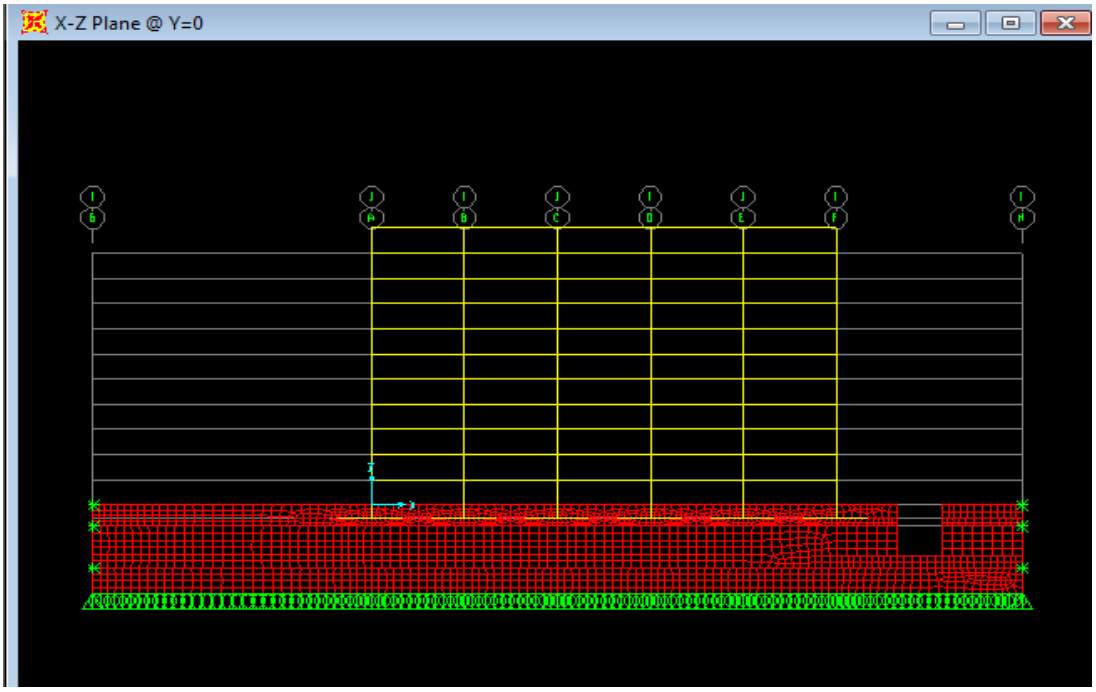

Fig 5: 3m distance and 6m depth

IV. RESULT AND DISCUSSION

An attempt is made to understand the behavior of the existing structure when the deep excavation is carried out at a distance of 1m, 2m and 3m from the existing building and excavation depth of 6m. Fig 6 and 7 shows that displacement of existing building at 1m ,2m ,and 3m distance and depth of 6m in X and Y direction , Fig 8 shows that bending moment of existing building . From the figures it's clearly shows that displacement is more in 1m distance and 6m depth that is effect of displacement and bending moment is more near the deep excavation.

A. DISPLACEMENT:

CASE1: DL+LL+EQX (Unit: mm) (Ux)

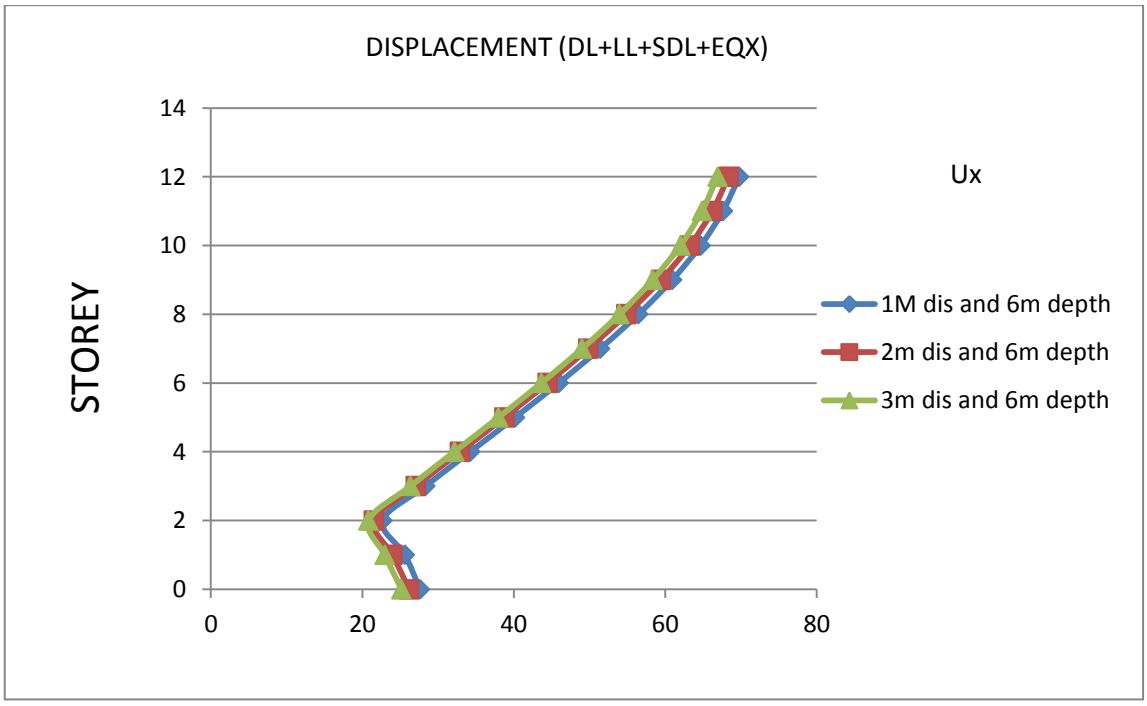

Fig 6 : Displacement (DL+LL+EQX) (Ux)

CASE2: DL+LL+EQX (Unit: mm) (Uy)

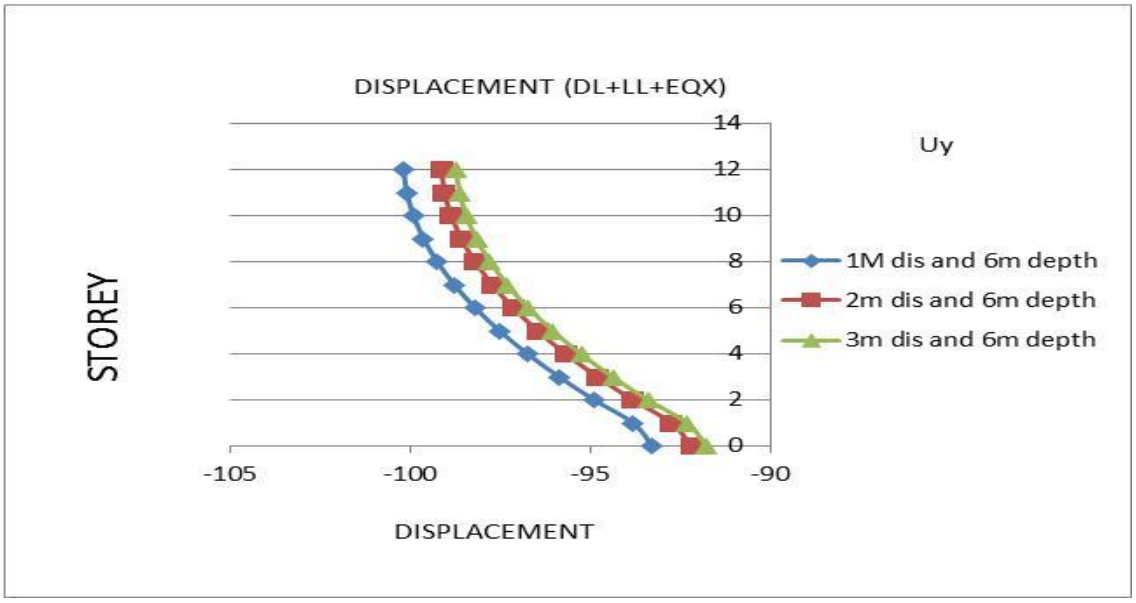

Fig 7 : Displacement (DL+LL+EQY) (Uy)

B. BENDING MOMENT:

CASE: DL+LL+EQX

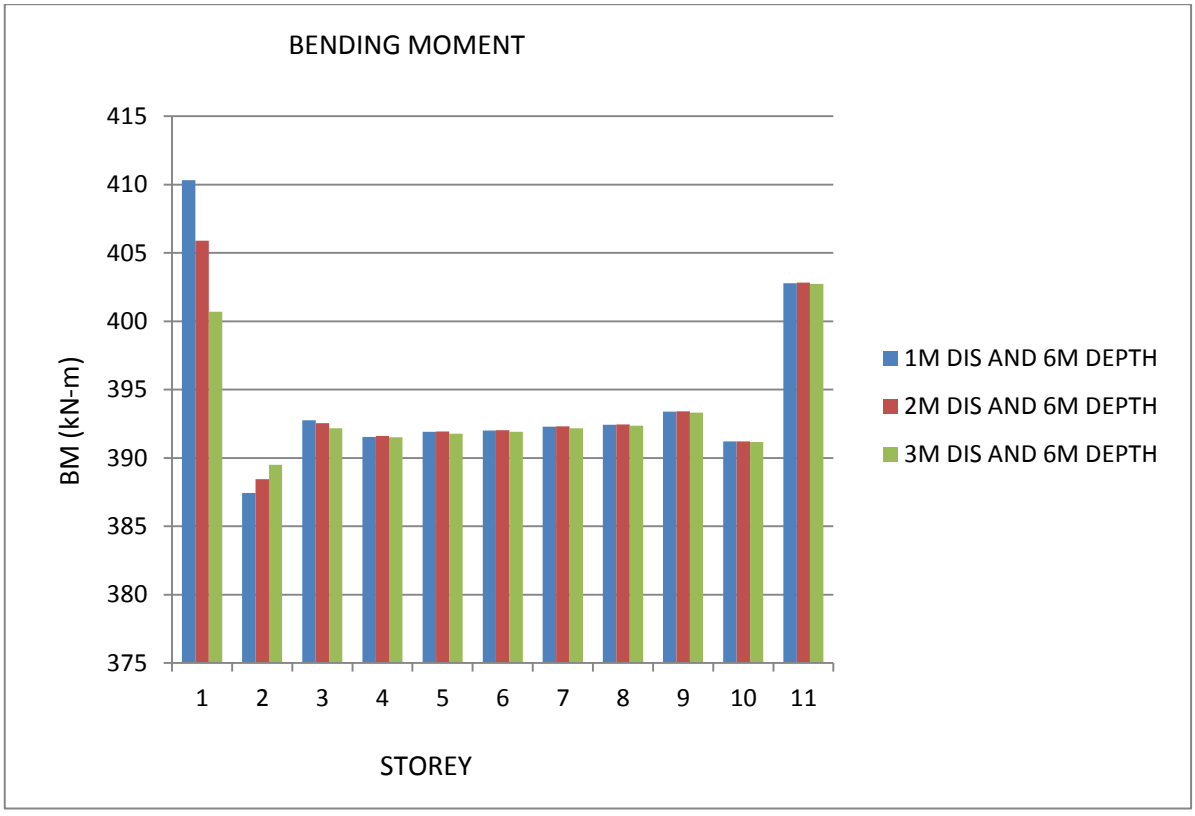

Fig 8: Bending moment (DL+LL+EQX)

C. PROVIDING BRACING WALL SYSTEM TO THE DEEP EXCAVATION:

An attempt is made to study the Provision of bracing wall for the deep excavation is good technique in avoiding damages to the existing buildings from the ground movement, settlement, bending moment etc. Fig 10 shows that displacement is reduced after providing bracing wall for the deep excavation.

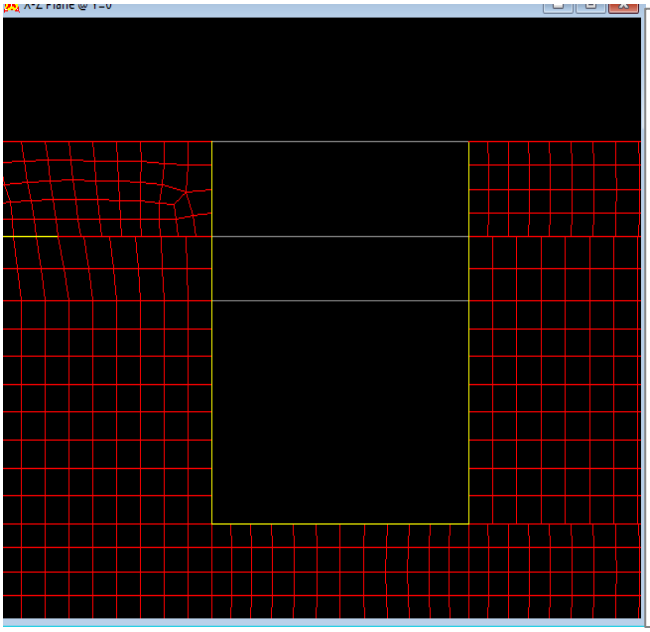

Fig 9: Provision of Bracing wall

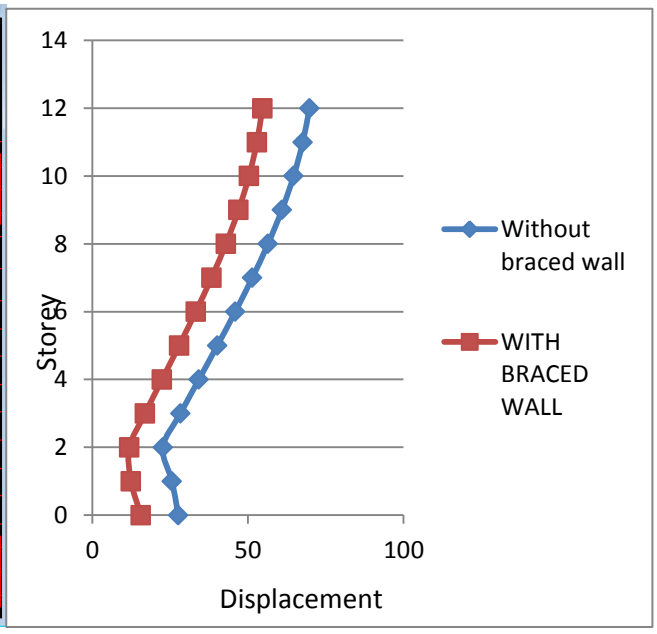

Fig 10: Displacement in with and without braced wall.

V. CONCLUSION

In the present study an attempt has been to study the deep excavation and its effects near to the existing structure.

1. In the present study deep excavation carried out near to the existing building and the results shows that the displacement is more in 1m distance and 6m depth compared to other cases. Effect of excavation is more near to the existing building.

2. Bending moment is more in 1m distance and 6m depth compared to other cases.

3. To prevent the effect of excavtion near to existing building bracing wall system can be provided to give the stiffness to the existing structure.

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