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Design of R.C.C. Framed Structure Considering the Effect of Stiffness of Slab A Review

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ABSTRACT

The slab is a crucial structural component and one of the members that uses the most concrete. The slab thickness increases as the load on it increases or as the space between columns becomes more clear. Due to the increased consumption of materials like steel and concrete, the slab's self-weight increases. Therefore, by taking the slab's stiffness into account, the self-weight of the slab can be reduced. The ability of a structure to withstand deformation is indicated by its stiffness.

The purpose of this study is to comprehend how moments created in columns behave when the slab's stiffness is taken into account. The behaviour of floor slabs in the frame as a result of vertical loading and the moments created in columns was the major focus of the current paper. The frame has been modelled using STAAD software both with and without taking slab stiffness into account.

Keywords : STAAD software, Storey building, Solid Slab

I. INTRODUCTION

The ability of a structure to withstand deformation is commonly regarded to be a structure's stiffness. The ability of a structure to resist deformations brought on by applied load is referred to as structural rigidity. With the use of higher strength and new materials in reinforced concrete, the importance of serviceability limits states becomes more apparent. At the moment, deflections of reinforced concrete slabs must be calculated for slabs with thickness less than specified values in the American codes (ACI 318M-95).

Generally speaking, the slab was solely intended to withstand vertical loads. Additionally, slab deflection becomes more significant when a building's span lengthens. As a result, the slab's thickness rises. As slab thickness increases, slabs become heavier, resulting in larger bases and columns.

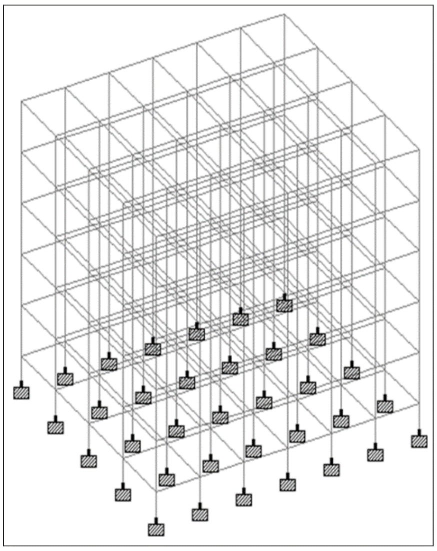


Fig. 1: Storey building without slab

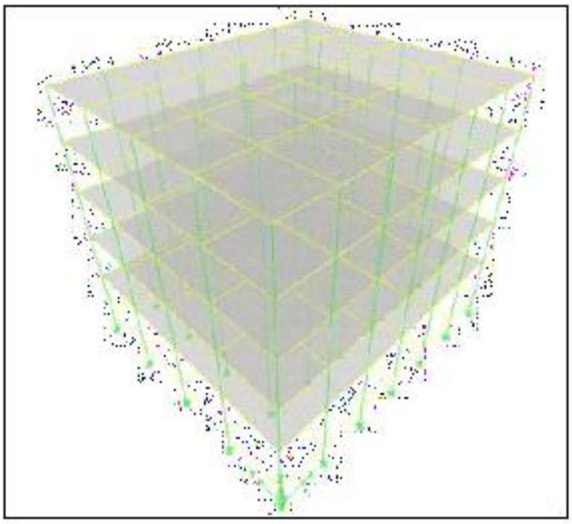


Fig. 2: 3D view of 5 storey building with slab

A flat slab is a reinforced concrete slab that typically has no beams and transfers loads straight to the concrete columns that support it. Therefore, the columns will experience substantial deflection. Numerous studies have been conducted, and researchers advise designing the structure with the slab stiffness and solid slab in mind in order to avoid this. It lessens the deflection that occurs in the column as well as the moment that is induced in the columns, which is lowered by 10 to 15% when compared to the moment that occurs in the column when the slab is flat. By increasing the moment and axial forces carrying capacity of the column by roughly 10 to 15% in the solid slab, it makes the building stiffer.

II. METHODOLOGY

The following methods was used to accomplish the aforementioned goals:

1) A review of the current literature conducted by various researchers and the Indian Design Code Making provisions for the slab's design

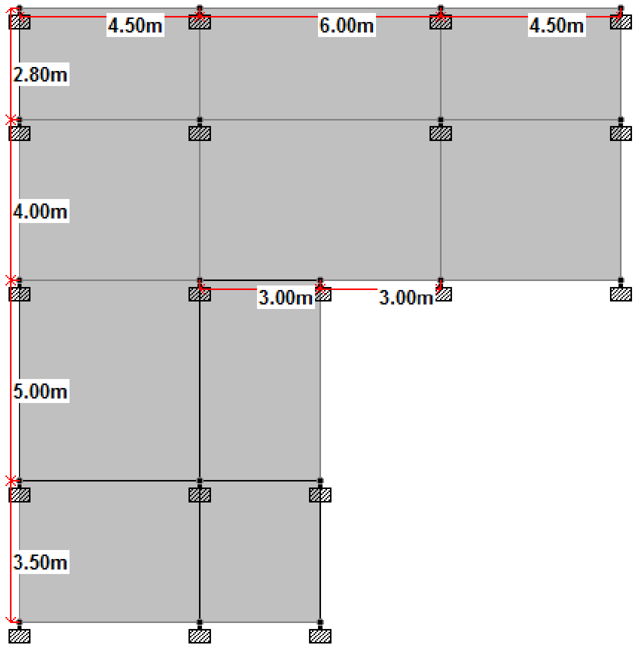
2) A thorough assessment of the literature on the application of slab stiffness in framed structures.

3) Applying static analysis to the creation of stronger structures.

4) Use STAAD Pro and the finite element method to calculate the moments that occur in beams and columns with and without taking plate stiffness into account.

5) A comparison of the moments that happen in beams and columns with and without taking plate stiffness into account.

6) The observations of the outcomes and discussions come last.



Dead Load: The dead load itself indicates self weight of the beams and columns. The unit weights of some materials are given from Table-1, IS 875 (part-1):1987. Unit weight of Reinforced concrete, γc= 23.5 kN/m^3

Lateral loads due to earthquake: The lateral loads were calculated in X-direction according to IS 1893 (part -1):2002 and applied at the nodal points in a direction considered. The lateral load along X-direction is denoted as EQx and the lateral load along Z-direction is denoted as $EQ_{z.}$

Load combinations: The load combinations considered in the analysis according to IS 1983: 2002 are given below:

COMB1 = 1.5(DL+LL)

COMB2 = 1.5(DL+EQ)

COMB3 = 1.5(DL-EQ)

COMB4 = 0.9DL-1.5EQ
COMB4 = 0.9DL+1.5EQ

III. RESULT AND DISCUSSION

1) The maximum capacities of the columns and beams were increased.
2) The moment that occurs in beams and columns is different from the moment that occurs in beams and columns without taking the stiffness of the slab into account.
3) The RCC-framed structure's maximum capacity was strengthened.

IV. CONCLUSION

In the publication mentioned above, extensive research was done on the static analysis of solid slab buildings. I want to compare the analyses of two models, the slab without stiffness and the slab with stiffness (solid slab).

1) The corner columns show a significant reduction in moment when the stiffness of the slab is taken into account, according to my analysis.
2) The column's deflection can be lessened.
3) The solid slab effect considerably lowers the need for reinforcement in the column in the longer direction.

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