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Analysis of G+4 Building with or without inclined member (Haunch) for supporting floating column

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ABSTRACT

In today's world the needs of people are changing very rapidly. As a result requirement for more space for parking areas, lobbies are increasing day by day, hence nowadays the floating columns are introduced in the buildings, but providing floating column is not safe as per the design is concerned, hence to support the floating column an inclined member named as haunch is provided to support the floating column and make the building more stable. This project deals with the comparative study of the analysis of multi-storied buildings with and without haunch provided at different positions, thereby aims at providing a safe position of haunch in a building. The equivalent static analysis is carried out on the school building of G+4 stories using STAAD PRO V8i software and a comparison of these models is carried out.

Keywords— Floating column, Haunch, STAAD PRO

1. INTRODUCTION

- Many urban multi-storied buildings in India today have a basic requirement of the first storey as an unavoidable feature. This feature is primarily being adopted to accommodate parking and reception lobbies in the first storey.
- Most of the time architect demands for aesthetic view of the building, in such cases many columns are terminated at certain floors and floating columns are introduced.
- The floating column is used for the purpose of architectural view and site situations. The provision of a floating column can be stated as most of the buildings in India are covering the maximum possible area on a plot within the available by-laws.
- Since balconies are not counted in Floor Space Index (FSI), buildings have balconies overhanging in the upper stories beyond the column foot print areas at the ground storey.
- To support the floating column an inclined member is provided named as haunch. Haunch is an inclined member that supports a floating column OR Haunch is an extension or knee like RCC member of the main column which supports the floating column.

2. MODEL FORMULATION

The study is being carried out on a building with or without haunch provided. The plan layout of the building is shown in the figure. The model is of a school building having G+4 floors. The height of each storey is kept same (i.e. floor to floor height = 3.2 m). The floating columns are provided from the first storey of the building and the trial of haunch positions at various distances is carried out from the ground floor. A cantilever is taken out from one side of a building up to 3m. The concrete grade used is M30 (i.e. $f_{ck}=30 \text{ N/mm}^2$) and steel grade as Fe500 (i.e. $f_y=500 \text{ N/mm}^2$).

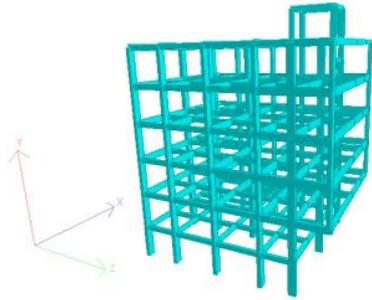


Fig.1 model without haunch

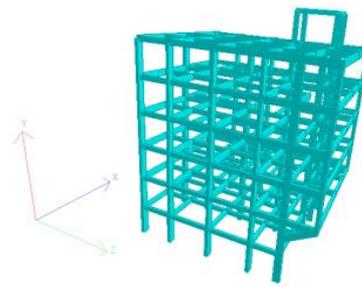


Fig. 2: Model with haunch (centre)

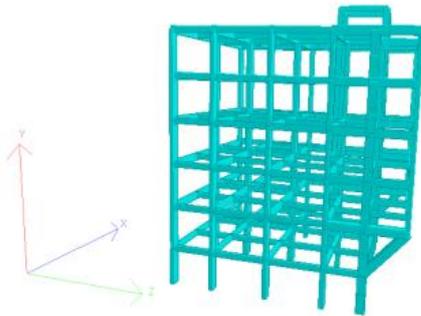


Fig. 3: Model with haunch (plinth)

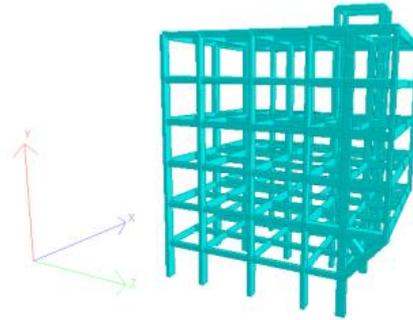
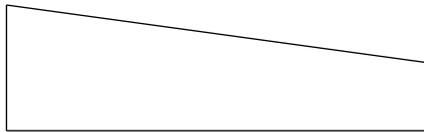


Fig. 4: Model with haunch (inclined support or tengda)

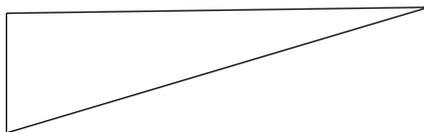
3. ANALYSIS OF BEAM

3.1 On the basis of SFD and BMD

- The observed beams are cantilever beams carrying point load and UDL over the entire span of first and second floor of all four columns i.e. column 1, column 2, column 3 & column 4.
- The standard SFD & BMD is as follows for a cantilever beam carrying point load and UDL over the entire span:



Standard SFD for a cantilever beam carrying point load and UDL over entire span



Standard BMD for a cantilever beam carrying point load and UDL over entire span

- After the beams have been studied, the SFD of all the beams of the second floor of all the four columns is satisfactory, and that of the first floor is suitable for the models in which haunch is provided from the centre of the column and without the haunch model.
- In case of the BMD, it is satisfactory for the models that haunched from the centre of the column on which the floating column rests.
- For the models with haunch (plinth) and haunch (tengda), the first-floor cantilever beams BMD, is of parabolic shape. That doesn't fulfil standard conditions.

3.2 On the basis of deflection

- The observed beams are cantilever beams carrying point load and UDL over the entire span of first and second floor of all four columns i.e. column 1, column 2, column 3 & column 4.
- The standard deflection values as per IS 456:2000 are as follows:

23.2.1 The vertical deflection limits may generally be assumed to be satisfied provided that the span to depth ratios are not greater than the values obtained as below:

a) Basic values of span to effective depth ratios for spans up to 10 m:

Cantilever	7
Simply supported	20
Continuous	26

- The beams on which the floating column rests after examining the beams, i.e. the cantilever beam on the first floor has different values for different models.
- Such as, the deflection value of beams is far more than the standard value as per code for the model without haunch provision.
- For the models of with haunch from centre, plinth & tengda, the beam deflection value is limited to the standard value as per the code. As in these 3 cases the cantilever beam will be considered as fixed beams for column 1 & column 4 on which the load of floating column in particular is transferred.
- Comparatively, on the model where haunch is given from the plinth level and where tengda is given, the deflection values are lower than the model where haunch is provided from the centre of the column.

4. ANALYSIS OF COLUMN

4.1 On the basis of axial load

- The column axial load must be in descending order from the bottom to the top of the column as the column load is more on the bottom side.
- The axial load is acceptable for all four models i.e. it is in descending order from the bottom to the top of the column.
- This result indicates the column is correctly designed.

4.2 On the basis of area of steel

- The column area of steel must be in descending order from the bottom to the top of the column as the column load is more on the bottom side.
- For all the four models the steel area is not ideal i.e. it is not in descending order from the bottom to the top as the load due to the floating column affects the steel area distribution.

4.3 On the basis of moment @ y-axis

- The comparison is made between the footing-to-second-slab columns and the second-slab-to-roof-slab columns, comparing the highest y-direction value.
- The column is said to be in suitable condition if the moment on the column is minimum.
- By evaluating all the four models, the model in which extra member is added, i.e. with haunch (tengda), gives satisfactory values on the columns where floating column load is transferred i.e. column 1 & column 4.

4.4 On the basis of moment @ z-axis

- The comparison is made between the footing-to-second-slab columns and the second-slab-to-roof-slab columns, comparing the highest z-direction value.
- The column is said to be in suitable condition if the moment on the column is minimum.
- By evaluating all the four models, the model in which haunch is added from the centre, i.e. with haunch (centre), gives satisfactory values on the columns where floating column load is transferred i.e. column 1 & column 4.

5. FUTURE SCOPE

Needs are never-ending concepts, when you get one you need more; the same applies to technology also. We will need more space in less usage, but for a longer lifetime. By using haunch, we can fulfil all the above-mentioned needs. In the future also it will be beneficial for increasing the life of the structure as the haunch is going to decrease the load on the beam, on which the floating column is rested. These types of models would allow designers and architects to build more creatively according to the requirement and to plan in terms of longer cantilevers.

6. CONCLUSION

- By comparing all four models, the model in which haunch is provided gives better results than the model in which haunch is not provided by considering deflection, axial load, area of steel and moment @ y-axis & z-axis.
- Since the cantilever span provided is of 3 m the concrete grade given is M30 (i.e. $f_{ck}=30 \text{ N/mm}^2$) and steel grade as Fe500 (i.e. $f_y=500 \text{ N/mm}^2$) and if the grades given less than these two the structure would not be safe.
- The model in which haunch is given from the middle, i.e. with haunch (centre) model, provides good results compared to the other three models with all the considered factors (i.e. deflection, axial load, area of steel and moment @ y-axis & z-axis).
- The model in which haunch is provided from the centre i.e. with haunch (centre) model is ideal for practically constructing because it will provide enough overhead.

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8. REFERENCES

- [1] Ogawa, T., Teshigawara, M., Nakamura, A., Takahashi, S., Kotani, G., Kawai, T., ... & Umeno, T. (2012). Effects of Haunch on the Beam-Column Joint of Soft First-Story in RC Building. In *The 15th World Conference on Earthquake Engineering*.
- [2] Tena-Colunga, A., Archundia-Aranda, H. I., & González-Cuevas, Ó. M. (2008). Behavior of reinforced concrete haunched beams subjected to static shear loading. *Engineering Structures*, 30(2), 478-492.
- [3] Kapil Dev Mishra, Dr. A. K. Jain. (2018). Comparative study of floating & non-floating column of plaza building subjected to seismic Loading By using STAAD-PRO software. *International Journal of Engineering Development and Research*, 6(3), 110-115.