EFFECT OF SEQUENTIAL CONSTRUCTION ON 
GIRDER SUBJECT TO FLOATING COLUMN

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Abstract - In structure some of the columns are not from 
ground and float from required storey level designed as 
floating columns with transfer girder support in multistoried 
bUILDINGS. In fact during construction, loads are applied in 
various stages as the floors are constructed storey by storey. In 
these paper two cases has been considered. Whereas in Case 1: 
The structure will be analyzed by comparison between with 
floating and without floating column by using ETAB software 
and in Case 2: The structure will be analyzed with reference to 
the girder subjected to floating column using sequential case 
by using ETAB software. A detailed study and comparison of 
the variation in bending moment in case of girder subjected to 
floating column and without floating column. The building is 
analyzed and designed using ETAB software.

Key Words: floating column, girder, displacement, 
reactions, etc.

1. INTRODUCTION

Nowadays big cities are facing huge problem of parking 
space and basement area in multi storey building. Often 
ground floor of building is kept open to accommodate 
parking space and basement. To keep ground floor open 
floating column are used in the structure. Due architectural 
requirement some of the columns are designed as a floating 
column which rest on the transfer girder which rest on the 
Shear wall in multi storey building. Two cases have been 
considered for study and comparison where as in case 1 the 
structure will be analyzed by comparison between with 
floating and without floating column by using ETAB software 
and in case 2 the structure will be analyzed with reference to 
the girder subjected to floating column using sequential case 
by using ETAB software.

Bending moment for floor to floor is calculated separately by 
using ETAB software.

1.1 FLOATING COLUMN

A column is vertical member starting from the foundation 
level and transfer the load to the ground. Floating columns is 
vertical member and it rest on beam which is horizontal 
member. Beams in turn transfer the load to other column 
below it. Floating columns are used above the ground floor 
where girders are used so that open space is available in the 
ground floor. Open space can be used for parking vehicles, 
basement purpose or assembly hall. The transfer girder is 
designed and detailed properly in earthquake prone area. 
ETAB can be used for the analysis of floating column 
structure. Floating columns are competent enough to sustain 
the load but girder should be of adequate dimension.

1.2 METHODOLOGY

a) First select the residential building and study the 
architecture and structural drawings of the building.
b) Fix the column location and decide the cross sections of 
the element.
c) Modeling of regular structure, semi column and analyze it 
by static linear method.
d) Designing, optimizing and redesigning the structure.
e) Removal of column and make it floating column and 
assign girder to floating column.
f) Analyze the floating column structure and find the 
moment of girder for various load combination (total dead 
load is very important). Re-analyze with add sequential 
construction case.
g) Compare girder with and without construction case and 
various other comparisons like lateral storage, drift, 
displacement, reaction, etc.
h) Compare girder moment for dead load for sequential 
construction case.
2. LITERATURE REVIEW

Maison Bruce F. and Neuss Carl F et. al [1] says the total seismic base shear as experienced by a building during an earthquake is dependent on its natural period, the seismic force distribution is dependent on the distribution of stiffness and mass along the height. The behavior of a building during earthquakes depends mainly on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. The earthquake forces developed at different floor levels in a building need to be brought down along the height to the ground by the shortest path; any deviation or discontinuity in this load transfer path results in poor performance of the building. Buildings with vertical setbacks (like the hotel buildings with a few storey’s wider than the rest) cause a sudden jump in earthquake forces at the level of discontinuity. Buildings that have fewer columns or walls in a particular storey or with unusually tall storey tend to damage or collapse which is initiated in that storey.

Kim H S et. al [2] says that multistoried buildings have been analyzed for years on the assumption that whole of the load is applied on the complete frame. Looking in to the mode of incidence of the load, it is evident that part of the load is applied in stages as the construction of the frame proceeds, whereas the remaining part of it is imposed on completion of the frame. The main factors affecting the limit state of serviceability of structure are: 1. Creep and shrinkage. 2. Span and cross section of the structural members. 3. Cycle time for floor to floor construction and strength of concrete. Staged construction allows defining a sequence of stages wherein one can add or remove portions of the structure, selectively apply load to portions of the structure, and to consider time dependent material behavior such as aging, creep, and shrinkage. Staged construction is variously known as incremental construction, sequential construction, or segmental construction. It is evidenced that simulation of sequence of construction in the analysis leads to considerable variations in deformations and design forces obtained by conventional one step analysis. It is, therefore necessary that for Multistoried building frames with transfer girders and floating columns system, the construction sequence effect shall be taken into consideration.

Sukumar Behera et. al [3] says in case structures to avoid earthquake damages, special arrangement needs to be made to increase the lateral strength and stiffness of the members. As per IS 1893 (part-1): 2002, Dynamic analysis (Linear or Non-linear) of building is carried out including the strength and stiffness effects and inelastic deformations in the members and the members designed accordingly. The lateral loads due to earthquake were calculated using Response spectrum method as per IS 1893 (part-1): 2002.

Kwak HG and Kim JK et. al [5] says Floating column is vertical member and it rest on beam which is horizontal member. Beams in turn transfer the load to other column below it. Floating column is used above the ground floor where girders are used so that open space is available in the ground floor. Open space can be used for parking vehicles, basement purpose or assembly hall. The transfer girder is designed and detailed properly in earthquake prone area.

TECHNICAL WORK

The below figure shows the 3D image of the structure and second figure shows the column position of the multi storey building.
building. It supports vertical wall and consist of single piece or consist of more than number of pieces bound together. Girder is primary beam that are used at the place where wide space is available. These main beams which are also called as bridge girder in case of bridges. It supports smaller beams and other structure components. Girders are made up of built up sections and carry heavier loads over large spans.

Floating column is vertical element which rest on a beam which is horizontal element. Beam in turn transfers the load to other columns below it. Floating column is usually adopted above the ground storey level so that the space available can be used as parking space, basement area, etc.

In this paper regular structure (Without floating column) is used to find the reaction of column no 12, 15 and 19. Reactions are included in results given below. In next part project will consist structure with floating column to find reactions and also the girders are used. Also next part will include comparison sheet.

**EXPERIMENTAL CALCULATIONS AND RESULT**

Case 1: The building will be analyzed by without floating column and no girder beam by using ETAB software.

Below is the reaction table of column number C12, C15 and C19

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<th>Story</th>
<th>Point</th>
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<th>LOAD</th>
<th>Mx</th>
<th>My</th>
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<tr>
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<td>129.4</td>
<td>6.7</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Case 2: In next stage building will be analyzed with reference to the girder subjected to floating column using sequential case by using ETAB software.

**Table -1:**

Fig -1: WITHOUT FLOATING COL 15 AND NO GIRDER BEAM

Fig -1: WITH FLOATING COL 15 AND GIRDER BEAM
Fig 2: WITH FLOATING COL 15 AND GIRDER BEAM

3. CONCLUSIONS

Transfer girder is safe in shear and bending. Provision of floating column is yet not disclosed or provided any detailed description in Indian standard codes. Construction sequential case has more bending movement and shear force value when compare to other combinations. Rise of approximately 46.17% in bending moment was observed.

REFERENCES


[6] C M Wanga, Z Y Taya, Department of Civil Engineering, National University of Singapore, Kent Ridge, Singapore 119260