SEISMIC ANALYSIS OF A (G+7) MULTISTOREY BUILDING WITH AND WITHOUT HANGING COLUMNS-A COMPARATIVE STUDY

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Abstract: **In the new multi-story construction in urban India, today buildings with the Hanging column have become a traditional feature. In building constructed in seismically active areas, these features are extremely undesirable. The importance of the role of the Hanging column in building analysis was clearly highlighted in this report. Alternate steps to minimize anomalies in the Hanging frames, including the stiffness balance of the first stage and above. Buildings with a Hanging column in the current scenario are a typical feature of contemporary urban India construction. In building constructed in seismically active areas, these features are highly unwanted. This research emphasizes the significance of the Hanging column in the building analysis specifically. Alternate steps to reduce the irregularity of Hanging columns, including the stiffness balance of the first and last stages, are proposed. In order to investigate the response to different earthquake arouses the structure with different often contents and time-content factor, FEM codes are created for 2D multi-story frames with and without Hanging columns. Both frames with and without Hanging columns are determined by time history of floor shift, inter level drift, base shear, rotating moment. The research is conducted on a Hanging column structure. This detailed figure shows the structural layout of the building. The building considered for the analysis is a G+9 residential home by using STAAD.Pro Software. Each store's height is the same as other common data. Complete analysis where done and finally the building with Hanging column has been found to have less base shear than a building without Hanging column. The Hanging column also falls from the lower to top level of the base shear value as the Hanging column changes. Building with Hanging column was also found to have more displacement than building without the Hanging column. Moving the Hanging column from the bottom to the top floors also improved displacement values. Building with Hanging column was found to have more floor drift than building without a Hanging column. Shift of Hanging columns from bottom to top rates was also observed to increase the storey drift values.**

Keywords: **FEM, G+9 Building, Hanging Column, Seismic Loading, Drifts.**

1. Introduction

Today, several multi-story urban buildings in India are unavoidably accessible in the first floor. This is used primarily for parking or reception lobbies on the first level. Although the overall seismic basis shear encountered by an earthquake building depends on its natural duration, the distribution of seismic force depends on a height distribution of steepness and mass. In addition to the way the earthquake forces are brought to the ground, the action of a building in an earthquake depends critically upon its overall form, size and geometry. At different rates in a building the earthquake forces have to be carried down by the shortest path down the height to the ground; any inconsistency or discontinuity in this load transfer path contributes to a poor building efficiency.
Vertical reverse buildings (such as a hotel with few floors wider than the others) cause the earthquake forces to unexpectedly leap at discontinuity. Buildings with less columns or walls or with an unusually high amount appear to damage or collapse in the storey. Throughout the 2001 Bhuj earthquake, several buildings in Gujarat with open ground floor to parking were collapsed or seriously damaged. Buildings with columns hanging or Hanging on beams in an intermediate floor that do not meet the base have discontinuities in the transmission route for loads

2. What is Hanging column?

The Hanging column is a vertical component that sits on a beam but does not directly move the load to the foundation. There was a mistake. But on the beam rests the Hanging board. Column structure for hanging or Hanging. It ensures that the beam supporting the column acts as a foundation. This structure is known as a transmitting structure. A vertical component from base level and transfering the load to the ground is expected to be a column. The term Hanging column is also a vertical feature that (due to the nature / position of the architecture) rests on a beam that is a horizontal part of the lower point (termination point). The beams move the load to other columns below it.

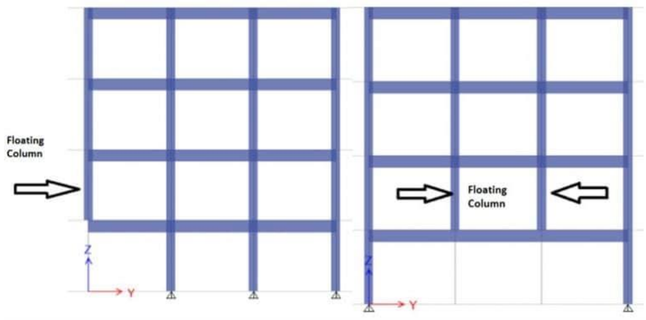

Figure 1: Hanging Column

Most projects include Hanging columns, in particular above the ground floor, where transfers are used to create more room in the ground floor. For assembly and parking purposes, such open spaces can be needed. In Earthquake zones, the transfer belt must be correctly constructed and described. The beam supports the board, a focused load.
With regard to the analysis, the column is always taken as a point load on the transfer beam and is fixed at the foundation. For the study of this type of structure, STAAD Pro, ETABS and SAP2000 may be used. Hanging columns are capable of bearing a weight load but the girder must be fairly steep with very limited deflection. Of course, looking forward, one can always find buildings more fascinating than monotonous. This should not, however, be achieved at the risk of bad conduct or building protection due to an earthquake. Architectural features that are detrimental to the buildings' earthquake response should be avoided. If not, they will be reduced to a minimum. If unusual features are used in buildings, considerably more engineering work is needed to design the building, even with simple architectural features the building may not be as good as the one. Therefore, in seismic areas, the structures already constructed with these discontinuous members are threatened. Yet such structures can not be demolished; rather, research may be performed to strengthen the structure or to suggest some remediation. The columns on the first floor can be reinforced, the rigidity of these columns can be improved by upgrading or braced to minimize lateral deformation.

3. Objective and Scope of present work

The target of the current research is

- Researching the behaviour, in earthquake encouragement, of multi-story buildings with Hanging columns.
- The seismic analysis of the building with Hanging column is used for analyzes of the impact of staad pro.
- Investigate the displacement of base shear between Hanging columns in a G+9 Residential Mutistorial building at different locations.

4. Research Significance

In urban areas, multi-story buildings are designed for the various purposes mentioned above by having Hanging pillars in the ground floor. Such Hanging column buildings are built for gravity loads and safely subject to gravity loads, but not for earthquake loads. Therefore, in seismically prone areas these buildings are dangerous. Throughout the earthquake-resistant architecture of multi storage buildings, the project aims to raise understanding of these problems

5. Methodology

The methodology is the theoretical and systematic analysis of the methods used for the study area. This involves the systematic study of an variety of approaches and concepts connected to a information branch.
Load taken into Account

Dead loads

The dead load involves the weight of the walls, divisional flooring, false ceilings, false floors and the other permanent structures. A load set in its size and location is called the dead load. Dead loads may be determined by the scale and weight of various members. For floors; unit weight of reinforces cement concrete= 25 kN/m3 Unit weight of steel is = 78.5 kN/m3

Imposed loads

The imported load shall be generated by the intended use or occupation, in which the weight and vibrating loads and dust loads, including the weight of mobile partitions, loads dispersed and concentrated. Charges levied shall not include charges caused by the wind, the seismic activity, the snow and loads place on the structure, the differential settlements to which the structure which experience a temperature change, creeping and shrinking.

For residential buildings such as Hostels, hotels, boarding houses, lodging houses, dormitories, residential clubs: Living rooms, bed rooms and dormitories = 4.0 kN/m3 (IS: 875, Part 2- 1987).

Wind loads

The strength of a structure due to the wind effect. As the building height increases the wind impact. At high wind speeds the wind typically blows horizontally to the ground.

6. Analysis of the Structure

The building employed in this study was designed according to the IS 800: 2007 and IS 1893 criteria (Part 1): 2002

STAAD Pro analyzes a multi-story steel structure
The architecture of the building depends on the minimum standards as laid down in the Indian Standard Codes. The basic standards for structural protection in buildings shall be protected by the concept of basic design loads to be assumed by the structure to bear for dead loads, imposed loads and other external loads. A 10 (G+9)-story steel frame is used for this analysis. The average height of the floor is 3 m and the building is 30 m. As shown in Figure 4.1, the laterals cover 24 meters by 20 meters and are divided into 4 square meter bays.

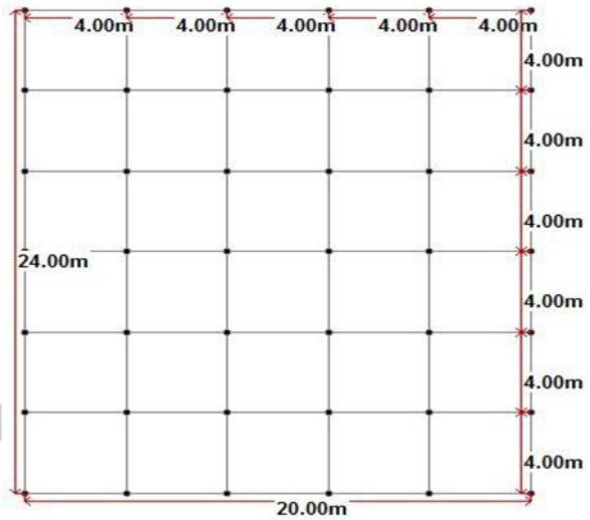

Figure 2: (G+9)-story Steel Frame Structure

For research , the following STRUCTUREs are examined:

- A Rectangular Structure without a Hanging base.
- Rectangular, Hanging column structure on the ground floor
- The rectangular structure with the 3rd floor Hanging column
- The Rectangular Structure at fifth floor with Hanging column

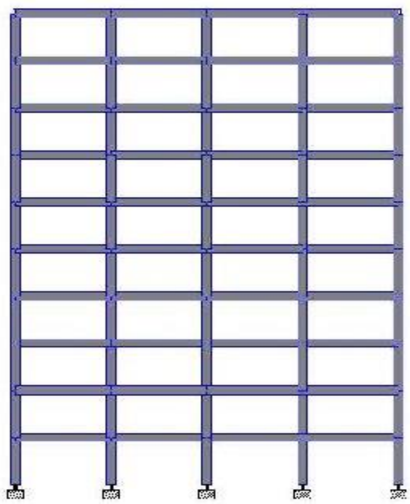

Figure 3: Rectangular Building without any Hanging column

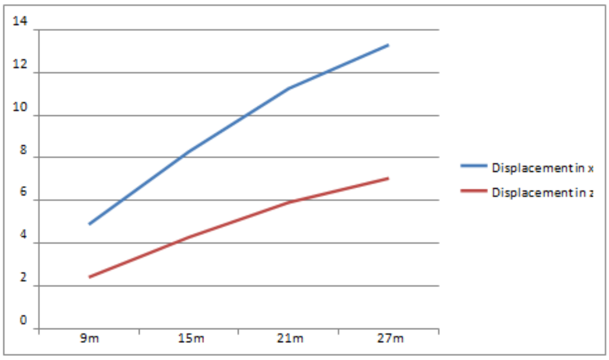

Figure 4: X-axis and Z-axis directions Displacements

It is observed from fig. 4.4 that as the height of building increases displacement is increasing from bottom to the top floor

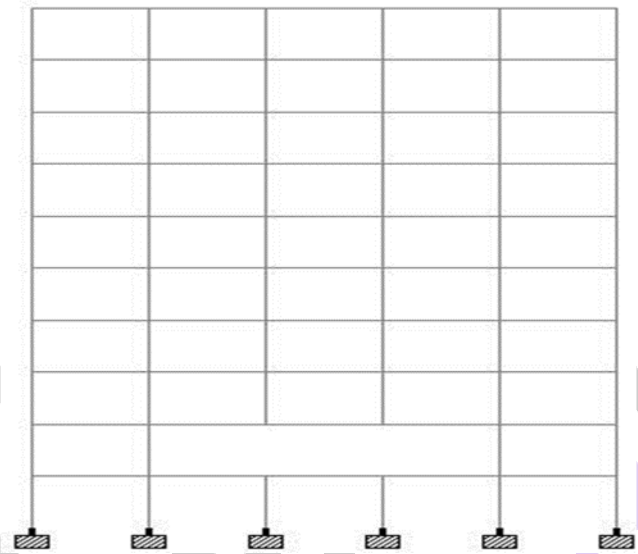

Figure 5: Square Building with hanging column at first floor

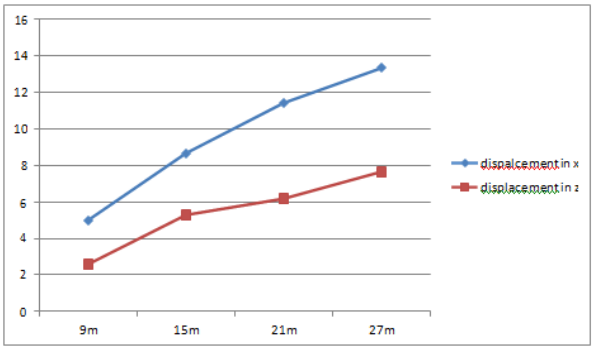

Figure 6: Displacements X-axis and Z-axis directions Displacements

7. Results and Discussions

On the basis of base and shelf changes, the results of the comparative study between a building without Hanging column and a Hanging column are carried out.

Base shear:

S.No	Seismic Weight	Base Shear	Time Period
Structure 1	52959.43	2206.30	0.94
Structure 2	52590.00	2205.80	0.94
Structure 3	52844.92	2201.93	0.94
Structure 4	52755.85	2198.26	0.94

Displacements at different heights:

a) In x-directions (in mm) :

S.No	9m	15m	21m
Structure 1	5.6032	9.2378	12.3277
Structure 2	6.0015	9.5231	12.3287
Structure 3	6.0004	11.3897	14.7385
Structure 4	6.1326	12.3726	16.7865

b) In z-directions (in mm) :

S.No	9m	15m	21m
Structure 1	3.5574	5.5823	6.7277
Structure 2	3.8588	6.2626	7.2828
Structure 3	3.4724	6.8262	7.9282
Structure 4	3.6599	6.2762	9.2929

CONCLUSIONS

In comparison to the previous height classifications, a broad system classification was introduced. Various structural structures have been defined with a focus on creativity within each classification group.
The following conclusions can be drawn on the basis of the current study:

- The building with Hanging column has been found to have less base shear than a building without Hanging column.
- The Hanging column also falls from the lower to top level of the base shear value as the Hanging column changes.
- Building with Hanging column was also found to have more displacement than building without the Hanging column. •
- Moving the Hanging column from the bottom to the top floors also improved displacement values.
- Building with Hanging column was found to have more floor drift than building without a Hanging column.
- Shift of Hanging columns from bottom to top rates was also observed to increase the storey drift values.

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