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RESEARCH ARTICLE OPEN ACCESS

Effect of provision of Bracings on Seismic Analysis of Building with Floating Column

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ABSTRACT
The principle objective of this project is to design and compare the models of G+ 7 storey (3-D reinforced Concrete frame) floating column buildings with and without bracings. The entire structure can be designed and analyzed by using STAAD pro software. In this project, we are designing a commercial building with floating columns to have column free space and also for aesthetic and functional requirements. Floating columns are vertical members that settle on the beam but does not transfer the load directly to the foundation. In construction, bracings are the system utilized to reinforce building structures where supports intersect. These bracings increase the building's capability to withstand seismic activity. Seismic wave is an energy wave that travel through the Earth's layers, that cause earthquakes, volcanic, magma movement, and man-made explosions that give out low-frequency acoustic energy. In different parts of the world earthquakes are demonstrated as the hazardous consequences and vulnerability of inadequate structures. In order to overcome these adverse effects we are providing bracings for the structure.

Keywords: Earthquake, Seismic waves, Floating columns, Analysis, Design, Bracings, STAAD Pro

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I. INTRODUCTION

Floating column is a vertical structural member that acts as point load on the beam that transfers the load to the columns below it and it may start on the first, second or any other intermediate floor while resting on a beam. A braced frame is a structural system commonly used in structures subject to the lateral loads such as wind and seismic pressure. The members in the braced frame are generally made of structural steel, which can work effectively both in tension and compression. The beams, columns that forms the frame carry the vertical loads, and then the bracing system carries the lateral loads. The positioning of braces, can be problematic as they can interfere with design of the facade and the position of openings. Buildings adopting high- tech or post-modernist styles had responded to this by expressing bracing as an internal or external design feature. Columns rest on foundation to transfer load from slabs and beams, but the floating column rests on the beam. This means the beam which supports the floating column acts as foundation and that beam is called as a transfer beam. This concept is widely used in high storied buildings for both commercial and residential purpose. This helps to change the plan of the top floors according to our convenience. The transfer beam which supports the floating column will transfers the loads to foundation. Hence this has to be designed with more reinforcement. Now-a-days multi-storey buildings are constructed for the purpose of residential, industrial, commercial etc., with an open ground storey has become a common feature. For the purpose of vehicle parking, the ground floor is kept free without any constructions, except for the columns which transfer

The building weight to thefoundation. For a hotels or commercial buildings, where the lower floors contain conference rooms, convention halls, lobbies, show galleries or parking areas, large vacant space is required for the free movement of people or vehicles. The columns which are closely constructed in theupper floors are not advisable in the lower floors. So, to avoid this phenomenon, floating column concept has come into existence. In urban areas, multi storey building s are built by proving floating columns at the floor for the various uses which are stated above. This floating column structures is considered as safe under the gravity loads and hence they are to be designed only for those loads. But these buildings are not designed for the earthquake loads and therefore, these buildings may not be safe in seismically active areas. When floating columns are employed by the buildings, the entire earthquake of the system is shared by the column or the shear walls without considering any contribution from floating columns. Though the floating columns are discouraged, there are many projects where they are adopted and especially above the ground floor, where transfer girders are employed.

II .METHODOLOGY

The main objectives of the proposed work are: To compare the modal response of all the models like Mode shapes, Time period, Frequency. To compare the Base shear and Storey drift, Storey displacement and maximum displacement of each storey. To plot the response of the structure for the time history analysisif the structure is not properly designed and constructed with required quality they may cause large destruction of structures due to earthquakes.Response spectrum analysis is helpful procedure for seismic examination of the structure when the structure indicates linear response.Extensive literature survey by referring books and specialized papers did to comprehend essential idea of subject. Selection of an appropriate plan of G+7 storey building. Computation of the loads and also selection of preliminary cross-sections of. Geometrical demonstration and structural analysis of building for various loading conditions as per IS code provisions Interpretation of results incorporate base shear, storey float and storey diversion. In the present work it is proposed that to complete seismic investigation of multi-storey RCC structures utilizing Response Spectrum Analysis method considering mass irregularity with the help of STAAD Pro software.

Considering mass irregularity with the help of STAAD Pro software. A thorough literature review to understand the seismic evaluation of building structures and application by different linear and non-linear analysis has done. A hypothetical G+5 Building is selected and floating columns are provided at different levels of regular and irregular building and is modeled in STAAD Pro.Analysis of the building using linear static and nonlinear static analysis methods.

III. PARAMETRIC STUDY:

1. **Physical Parameters of Building**:

Length = 50 m, Width = 32 m
Each Floor Height = 3.3 m
Total height of building = 19.8 m
Live load on the floors is 3 KN/m2

2. **Criteria of concrete and steel used:**

Concrete - M25 grade
Steel - Fe 415 grade

3. **Properties:**

Column Section= 0.70 m x 0.50 m
= 0.60 m x 0.50 m
Beams Section= 0.60 m x 0.35 m
= 0.55 m x 0.35 m
Slab Thickness= 0.15 m RCC
Floor Height= 3.3 m

4. **Supports:**

The base supports of the structure were assigned as fixed. The supports were generated using the STAAD.Pro support generator.

5. **Materials for the Structure:**

The materials for the structure were specified as concrete with their various constants as per standard IS code of practice.

6. **Loading:**

The loadings were calculated partially manually and rest was generated using STAAD generator. The loading cases were categorized as:

- Seismic load
- Self-weight (include dead load from walls, floor finishes, roof treatment etc.)
- Live loads
- Wind loads
- Load combinations

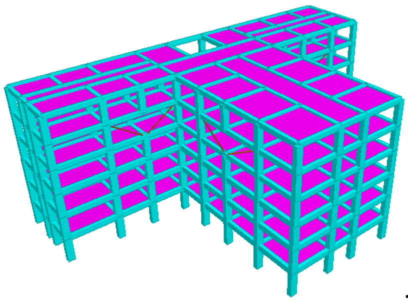

Figure: Rendering view of floating columns building with bracing

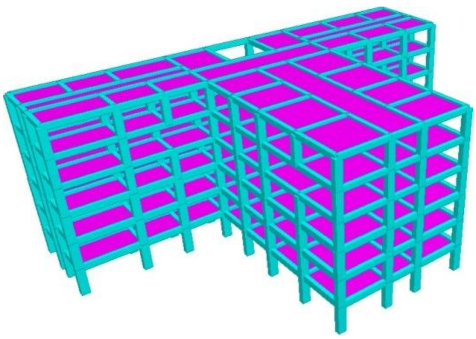

Figure: Rendering view of floating columns building without bracings

IV. ANALYSIS AND RESULT

The results shown explains the behavior of the nodal displacement of the whole structure which are analyzed from the building for two different models (structure with and without bracings) separately

Table: Nodal displacement of the storey in X direction

No. of storeys	Model 1	Model 2
1	1.997	2.014
2	5.579	5.539
3	9.876	9.390
4	14.945	13.773
5	18.369	17.885
6	26.689	20.884

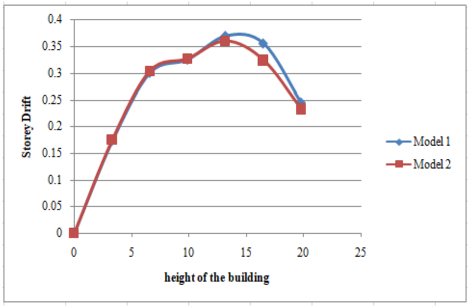

Figure: Nodal displacement of the storey in X direction

Table: Nodal displacement of the storey in z direction

No. of storeys	Model 1	Model 2
1	2.332	2.357
2	5.829	5.889
3	9.449	9.578
4	13.554	13.447
5	17.723	17.384
6	20.456	20.010

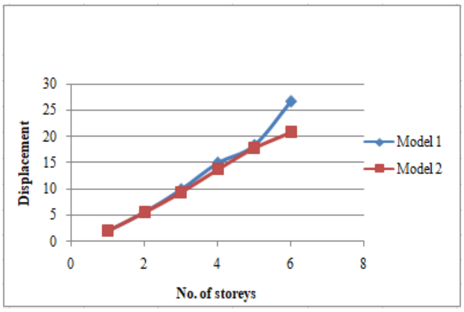

Figure: Nodal displacement of the storey in z direction

Table: Storey drift in X direction

Store y	Height (m)	Drift (cm)	
		Model 1	Model 2
1	0	0	0
2	3.3	0.173	0.175
3	6.6	0.301	0.305
4	9.9	0.326	0.328
5	13.2	0.370	0.361
6	16.5	0.356	0.325
7	19.8	0.245	0.233

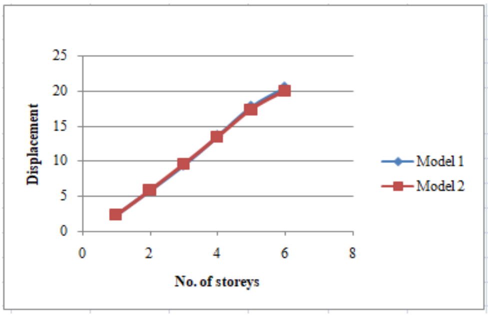

Figure: Storey drift in X direction

Table: Storey drift in Z direction

Storey	Height	Model	Model 2
1	0	0	0
2	3.3	0.229	0.231
3	6.6	0.348	0.350
4	9.9	0.356	0.360
5	13.2	0.391	0.384
6	16.5	0.389	0.356

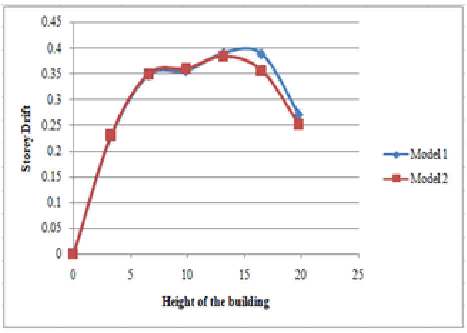

Figure: Storey drift in Z direction

V .CONCLUSION

The present project is done using STAAD.Pro which is located in Hyderabad. The loads are calculated namely, the dead loads which depend on the unit weight of the materials used like concrete, bricks and the live loads using the code IS:456-2000 and HYSD bars Fe415. The safety of reinforced concrete building will depend upon the initial architectural and structural configuration of the total building, the quality of the structural analysis, design and reinforcement detailing of the building frame to achieve stability of elements and their ductile performance. Proper quality of construction and stability of the infill walls and partitions are additional safety requirements of the structure as a whole. This project mainly concentrates on the analysis and design of multi-storied commercial building with all possible cases of the loadings using STAAD.Pro meeting the design challenges are described in conceptual way. We may also check the deflection of various members under the given loading combinations. Further in case of rectification it is simple to change the values at the place where error occurred and the obtained results are generated in the output. Very less space is required for the storage of the data.

Model 1: Floating column building without Bracings

Model 2: Floating column building with Bracings

•The analysis outputs were noted in terms of lateral displacements and storey drifts and were tabulated on the basis of seismic analysis.

•For both the cases considered drift values follow around similar path along storey height with maximum value lying somewhere near about the middle storey. The inter storey drift also increases as the increase in the number of story's.

•For both the models considered displacement values of the model 2 i.e., building model with floating columns are reduced by providing bracings.

•In all the models storey drift and displacement values are less for lower zones and it goes on increases for higher zones because the magnitude of intensity will be the more for higher zones.

•In order to minimize these effects we can provide bracings to the structure with floating columns. Bracing system has been considered most efficient measure against lateral loads all over the world.

•The storey drift and displacement is more for floating column buildings because as the columns are removed the stiffness of the building reduces and it becomes more flexible.

•By providing bracings drift and displacement values reduces as compared to model without bracings.

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