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Analysis of C- Shaped Irregular Building using Staad Pro with Floating and Non-Floating Columns at Different Floor Levels

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Abstract: Floating columns and swimming pool are widely used in modern urban multi-storey construction to meet architectural and parking needs. These are severely vulnerable to seismic loads due to broken load transfer paths. In the present study, an irregular C-shaped plan building with floating and non-floating columns at different floor levels with swimming pool provision using STAAD Pro is dealt with. The presence of a swimming pool adds an additional significant dead load and current demand of architectural designs for buildings for longer spans, which further complicate the seismic behaviour of an irregular structure. Equivalent static and response spectrum analyses are carried out to estimate the storey drift, lateral displacement, base shear and torsional effects for different seismic zones. Special attention is paid to the structural response of the swimming pool floor where the transfer of the hydrostatic pressure and the heavy water load through the supporting beams and floating columns require a higher flexural and shear capacity. Six structural models (M1–M6) representing different column arrangements and different seismic zone (III to V) were analysed under lateral loading in the X- and Z-directions. To evaluate the critically loaded paths and safety margins of structure under combined gravity and lateral loads, the load combinations as per Indian standard codes are considered. The aim of this study to analyse the multistorey building under the effect of lateral forces act on it by earthquake loads and then compare the results in the form of storey drift and storey displacement, Base shear graphs for the different structural models under different seismic conditions. The provision of swimming pool in the building also effects the building seismic response which also be analyse by this study. The obtained results are systematically compared for evaluating the variation in seismic response of buildings with floating and non-floating columns at different floor levels. Comparison of storey drift and displacement helps in identification of structural configuration with larger lateral deformation and thus larger seismic demand. Lastly the deign performed on model M5 and M6 to check which way is economical to make earthquake resistance building.

Keyword Staad pro, Floating and non-Floating columns, Storey displacement, Storey drift, Base shear, c-shaped building, RSA, ESM.

I. INTRODUCTION

Architectural requirements in modern urban construction often led to irregular building configurations. Among them, C-shaped plan buildings are widely adopted for functional and aesthetic purposes. But such forms introduce torsional effects, irregularities of stiffness and complicated load distribution and make the structural analysis more critical. Irregular buildings are those that have significant variations in the structural configuration, distribution of mass, stiffness or geometry in the height and plan of the structure.

One of the most noticeable geometric irregularities among the various plan irregularities is the C-shaped building. Re-entrant corners and asymmetrical distribution of structural members can lead to non-uniform distribution of stiffness and mass. Thus, lateral forces may induce not just translational effects but also torsional effects. These effects can increase displacement, storey drift and may cause uneven distribution of forces between columns, beams and other structural elements. Hence, the analysis of C-shaped irregular buildings requires careful consideration of their three-dimensional structural behaviour. Fig. 1 shows the autocad plans of the building.

Fig. 1 Plan of building in Autocad

1) *Staad pro models* Fig. 2 below shows the Staad pro model planning plan for the building, which is driven from the AutoCAD file for performing analysis. The 3D structural models are developed using STAAD. Pro. The geometry of the structure is described by the nodes and the members of the structure connecting the nodes. The beams and columns are modelled based on the chosen C-shaped plan configuration and proper connections are made between successive floor levels shows in fig. 3

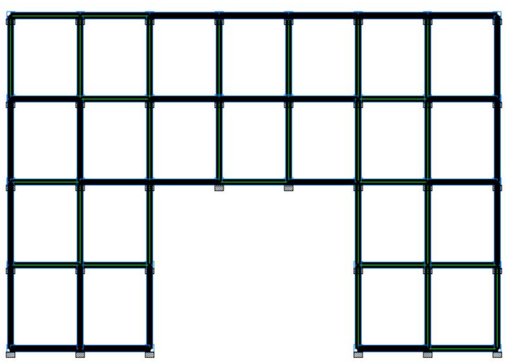

Fig. 2, 2D Plan in staad modelling

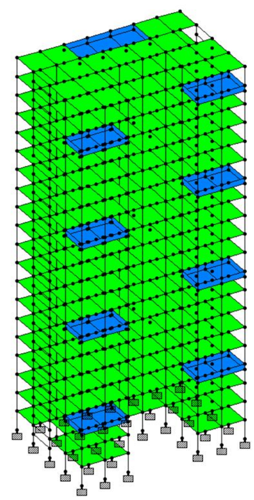

fig.3 3D modelling in staad

2) *Floating Columns* A floating column is a vertical structural element that does not extend all the way to the foundation. Instead, it ends on a floor at a mid-level and is supported by a transfer beam / girder. The transfer beam then transfers the load of the floating column to the columns or structural members below. Floating columns are widely used in multi-storey buildings to create column-free open spaces on the ground floor for parking, lobbies, or assembly halls. Fig. 4 shows floating column.

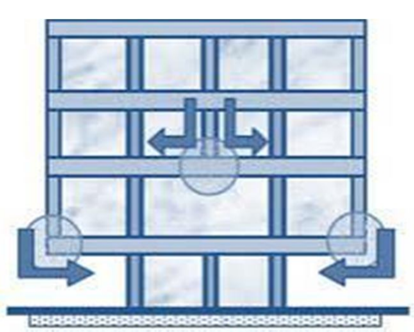

Fig. 4 Floating Column

3) *Non- floating Columns* Non-floating columns are vertical continuous elements extending from the upper floors down to the foundation. They offer a direct and efficient route for the transfer of loads from slabs and beams to the foundation and, consequently, to the supporting soil. These columns in a multi-storey building have an important role to play in the overall strength, stiffness and stability of the structure. Continuous columns provide more even distribution of gravity and lateral loads and prevent abrupt changes of structural stiffness. In this study, non-floating columns are considered as the reference structural configuration for comparison with floating-column models at different floor levels using STAAD. PRO.
4) *Storey drift: Storey* drift serves as a significant structural response indicator for analysing the lateral deformation of a multi-storey structure under horizontal loads, including those from earthquakes and wind. It is described as the lateral movement between successive stories of a building. In basic terms, storey drift indicates the extent to which a level shifts sideways compared to the floor below. Drift is distinct from the overall lateral displacement of the structure, since it takes into account the relative shifts between neighbouring levels.
5) *Storey Displacement The* storey displacement is taken as an important parameter for the evaluation of lateral response and seismic performance of the C-shaped irregular building with floating and non-floating columns at different floor levels. Storey displacement is the horizontal movement of a particular floor from its initial undeformed position due to lateral forces like earthquake and wind loads on the building.
6) *Base Shear it* is the total horizontal seismic forces acting at the base of a structure subjected to earthquake excitation. It is the total lateral force transferred by columns, shear walls and other load carrying members from superstructure to foundation. Base shear is one of the most important parameters for assessing the seismic response and overall lateral strength of a building.

$$V_b = A_h \, W$$

7) *Equivalent Static Method (ESM)* The Equivalent Static Method, also called the Seismic Coefficient Method, represents the dynamic earthquake effect by applying an equivalent set of horizontal static forces to the building. The total design lateral force acting at the base of the structure is called the design base shear.
8) *Response Spectrum Method* The Response Spectrum Method is a dynamic linear analysis method commonly used for earthquake-resistant design of multi-storey and high-rise buildings. A response spectrum represents the maximum response of a single-degree-of-freedom system having different natural periods when subjected to a specified ground motion or design spectrum.

II. LITRATURE REVIEW

1) *S. Singla Er. Ashfi Rahman (2015)* The study investigates the effects of the structural irregularity which is produced by the Discontinuity of a column in a building subjected to seismic loads. In this paper static analysis and dynamic analysis using response spectrum method is done for a multi-storeyed building with and without floating columns. Different cases of the building are studied by varying the location of floating columns floor wise and within the floor. The structural response of the building models with respect to Fundamental time period, Spectral acceleration, Base shear, Storey drift and Storey displacements is investigated. The analysis is carried out using software STAAD Pro V8i software. Keywords—Floating columns, static analysis, dynamic analysis, response spectrum analysis.
2) *Arpit Shrivastav, Aditi Patidar (SSRG - IJCE) (2018)* The object of the present work is to study the behaviour of multistorey buildings having floating columns under seismic forces and observe the effect of shear wall in the same building. For this purpose, three cases of multi-storey buildings are considered having 8 storey, 12 storey and 16 storeys. All the three cases are considered having floating columns provided with and without shear wall, and also analysed for zone III, zone IV and zone V by using software Staad.PRO. Observation shows that the provision of floating columns is advantageous in increasing FSI of the building but is a risky factor and increases the vulnerability of the building. It is observed from the analysis that lateral displacement and storey drift of the building increases from lower to higher zones because the magnitude of intensity will be more for higher zones. By the use of shear wall these parametric values reduce in all the models.
3) *Akash Agrawal1, Anurag Wahane (IRJET) (2020)* The study of behaviour of swimming pool as per the considered position of pool at the terrace floor of the high-rise regular building under Dynamic Response Spectrum Analysis (RSA) Using STAAD Pro. RCC frame Building with different position of swimming pool (i.e. One-Side, Two-Side, Three-Side, Centre) were taken for the study. The Walls/ Plates of pool is subjected to hydrostatic pressure due to water present along with the base of the swimming pool. The research also includes the study of seismic action on the surface plates of swim pool due to plate stress behaviour (Ref. Fig. 5.1-5.4). The main target is to achieve the efficient swimming pool position which can be applied in the high-rise building.

4) *Rashmi Agashe, Marshal Baghele, Vaishanvi Deshmukh, (IRJET) (2020)* This investigate is generally based on theoretical design and analysis of structural framed building. The entire process of structural planning and design required imaginations, sound knowledge and thinking. Analysis and design of G+4 story residential building structure by using IS Code method. Analysis and of entire structure have been complete by manually design and verifies by STADD Pro. Software. All the drafting and detailing was done by using Auto CAD, also serve as a base for transfer of the structure for analysis and design in STAAD Pro. In this project, the design of slab, beam, column, staircase, etc. is calculated by "Limit State Method" using IS: 456-2000 code book. Different load active on the member are consider according to IS: 875-1987 (part 1, part2, part3). Hence residential building is properly planed in accordance with National Building Code of India.
5) *Divya Nayak, Shubham Dashore (JETIR) (2023) The* objective of research is to investigate the seismic behaviour of floating column structure using Staad Pro software. The CAD modelling and FEA simulation is conducted in Staad Pro simulation package. The FEA is a viable tool in evaluating the structural characteristics of structure under dead load and seismic loading conditions. From the FEA analysis conducted on the structure, the critical regions of high deformation are obtained using Staad pro simulation software. The results have shown that corner point of structure has maximum deformation.

III. METHODOLOGY

The research methodology provides a systematic approach for analysis and evaluation of the structural performance of a C-shaped irregular building with floating and non-floating columns at different floor levels. The methodology followed in this study is adopted to study the effect of vertical column irregularity on the structural performance of an irregular multistorey building under gravity and lateral loads. The C-shaped configuration results in plan irregularity and floating columns lead to vertical discontinuity of load-transfer mechanism. The combined effect of their joint influences on structural performance is evaluated through a comprehensive three-dimensional analytical method. Steps wise procedure is described below.

1) Autocad Modelling

AutoCAD is a computer-aided design (CAD) software that is widely used to prepare accurate two-dimensional drawings and three-dimensional representations of structures. AutoCAD is widely used in structural engineering for preparation of building plans, elevations, sections, grids and structural layouts prior to detailed structural analysis and design. In this study, the C-shaped building plan is developed using AutoCAD and the geometrical configuration for the subsequent structural modelling is established. The drawing gives the basic dimensions and grid layout and position of structural components such as columns and beams.

2) Development of Three-Dimensional Analytical Models in Staad Pro. Modelling

The 3D structural models are developed using STAAD. Pro. The geometry of the structure is described by the nodes and the members of the structure connecting the nodes. The beams and columns are modelled based on the chosen C-shaped plan configuration and proper connections are made between successive floor levels. The three-dimensional modelling approach enables the structural response to be evaluated in both principal horizontal directions and allows the effects of plan irregularity and vertical discontinuity to be represented within a common analytical framework. Below are the photographs of the modelling of the building.

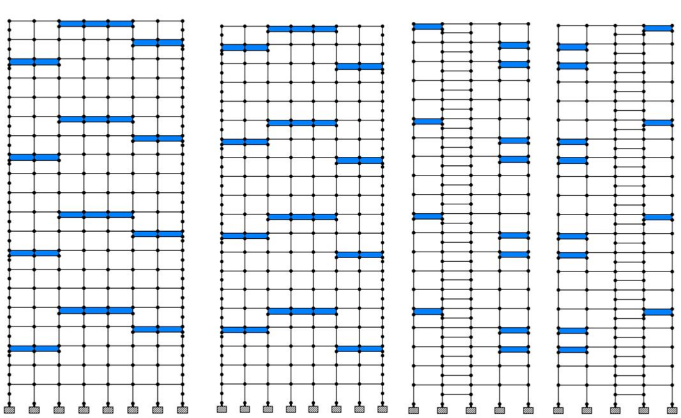

Fig. 5, 2-D Four side elevation of building

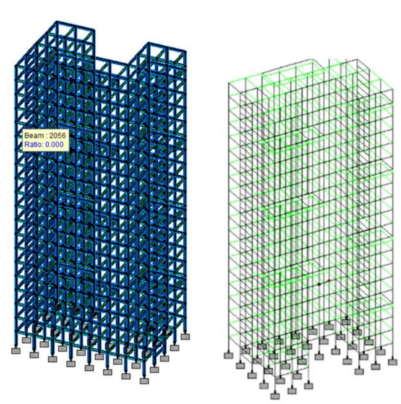

Fig. 6, 3-D Modelling of building

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3) Positioning Of Swimming Pool at the Different Floor Levels of the Building.

This Research investigates the inclusion of a swimming pool in a high-rise building as a practical architectural requirement that can have a significant impact on the structural design of an irregular building. Swimming pools are often placed at podium, intermediate, or upper levels of modern hotels, resorts, residential towers, and mixed-use buildings to meet functional and architectural requirements. The existence of a swimming pool on the upper level imposes additional permanent and imposed loads which may require larger spans, transfer beams, non-continuous columns and a changeover in the conventional structural load-distribution paradigm. The criteria are quite relevant to this study as the architectural design of C-shape is naturally plan irregular and the presence of floating columns introduces vertical discontinuity in the structure. In the analytical models, the swimming pool is considered as an additional structural and load bearing element at the floor level. The weight of the water in the pool creates a large vertical load that is transferred to the pool slab, the supporting beams, the columns and the structure as a whole. Besides the water load, the total gravity load may also incorporate the structural weight of the pool slab, walls, finishes, waterproofing, and other related permanent components. Furthermore, the hydrostatic pressure on the pool walls should be taken into account when the pool structure is explicitly modelled.

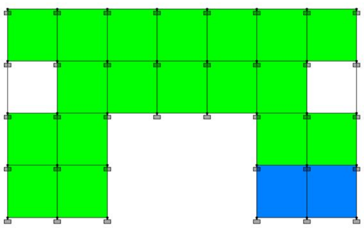

Fig. 7 swimming pool at right wing

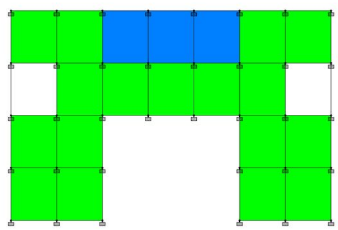

Fig. 8 swimming pool at rear wing

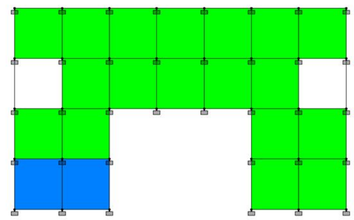

Fig. 9 swimming pool at left wing

4) All the models' parameters consider for the design

The analysis was carried out by dividing the building models into six different parameters to systematically evaluate their structural performance under different seismic conditions and to investigate the effect of floating columns. The six models represent combinations of floating and non-floating column configurations subjected to different seismic zones. In the following tables models are described with their parameters.

MODEL-1	
Floating columns	yes
Seismic Zone	III
Building height	80.0 M
Building width	35.0 M
Building depth	24.0 M
Floor height (G+20)	4.0 M
Zone factor (Z)	0.16
Importance Factor (I)	1.0
Response reduction factor (R)	3.0
Damping Ratio	0.005

MODEL-2	
Floating columns	NO
Seismic Zone	III
Building height	80.0 M
Building width	35.0 M
Building depth	24.0 M
Floor height (G+20)	4.0 M
Zone factor (Z)	0.16
Importance Factor (I)	1.0
Response reduction factor (R)	3.0
Damping Ratio	0.005

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MODEL-3	
Floating columns	yes
Seismic Zone	IV
Building height	80.0 M
Building width	35.0 M
Building depth	24.0 M
Floor height(G+20)	4.0 M
Zone factor (Z)	0.24
Importance Factor (I)	1.0
Response reduction factor (R)	3.0
Damping Ratio	0.005

MODEL-4	
Floating columns	NO
Seismic Zone	IV
Building height	80.0 M
Building width	35.0 M
Building depth	24.0 M
Floor height (G+20)	4.0 M
Zone factor (Z)	0.24
Importance Factor (I)	1.0
Response reduction factor (R)	3.0
Damping Ratio	0.005

MODEL-5	
Floating columns	yes
Seismic Zone	V
Building height	80.0 M
Building width	35.0 M
Building depth	24.0 M
Floor height (G+20)	4.0 M
Zone factor (Z)	0.36
Importance Factor (I)	1.0
Response reduction factor (R)	3.0
Damping Ratio	0.005

MODEL-6	
Floating columns	NO
Seismic Zone	V
Building height	80.0 M
Building width	35.0 M
Building depth	24.0 M
Floor height (G+20)	4.0 M
Zone factor (Z)	0.36
Importance Factor (I)	1.0
Response reduction factor (R)	3.0
Damping Ratio	0.005

5) *Assignment of Material and Section Properties* Structural components are assigned appropriate material properties. The material specification includes parameters like density, modulus of elasticity, Poisson's ratio and other characteristics needed for structural evaluation. The properties of beam and column sections are then designated according to the dimensions selected for the structure. The identical material and sectional characteristics are preserved for the comparative models whenever feasible to guaranty that the influence of floating-column placement is isolated as the primary research variable.

TABLE 1 PROPERTIES OF MATERIL ASSIGN

PROPERTIES	
Columns	0.6m x 0.6m
Beams	0.6m x 0.45m
Slab thickness	0.15 m
Thickness of brick wall	230 mm
Swimming pool wall TH.	0.25 m
Swimming pool Floor TH.	0.3 m
Grade of concrete	M30
Garde of steel	Fe 500

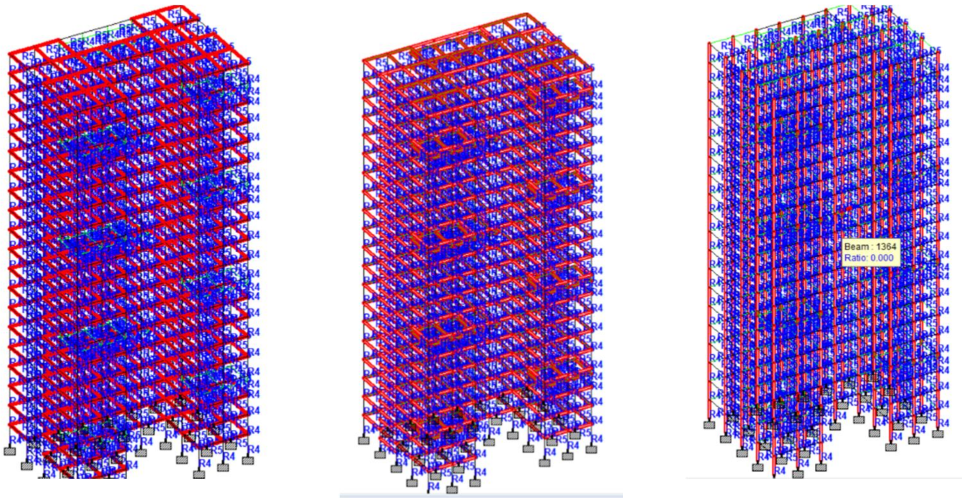

FIG.10 Assignment Of Properties

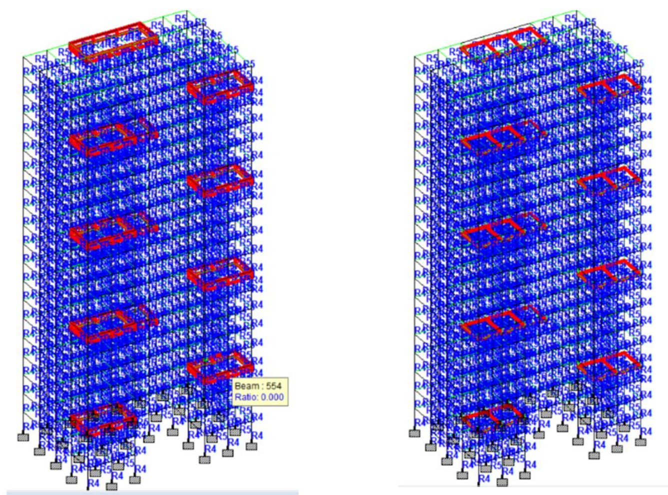

Fig.11 Assignment of Properties for Swimming Pool Wall and Floor

6) *Application of loads* The loads applied to a building are generally classified into dead load, live load, seismic load, wind load and special loads such as swimming-pool/hydrostatic loads. Here are the load categories you need to consider for your C-shaped irregular building with floating and non-floating columns. In table 2 the load calculations are given. Dead Load is the self-weight of the structural members and other permanent loads like floor finishes, masonry walls, waterproofing and other applicable components. Live load is assigned according to the occupancy and applicable loading provisions. Wind and earthquake loads are considered as lateral actions. The magnitude and distribution of these loads are determined using the applicable design provisions and the parameters adopted for the study.

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TABLE 2 LOADS EXPLANTION

LOADS				
SR.NO.	**DESCRIPTION**	**LOADS**	**VALUE**	**CODE**
1.	Dead load	DL	-	IS 875 PART-1 1987
2.	Wall load (230 mm th.)	WL	18.4 KN/M2	IS 875 PART-1 1987
3.	Live Load	LL	3 KN/M2	IS 875 PART-2 1987
4.	Earthquake loads X-direction	EQX	-	IS 1893:2016
5.	Earthquake loads Z-direction	EQZ	-	IS 1893:2016
6.	Wind load X direction	WLX	-	IS 875 PART-3 2015
7.	Wind load Z direction	WLZ	-	IS 875 PART-3 2015
8.	Wind load -X direction	WL-X	-	IS 875 PART-3 2015
9.	Wind load -Z direction	WL-Z	-	IS 875 PART-3 2015
10.	Hydrostatic load	HL	14.71 KN/M2	IS 875 PART-2 1987

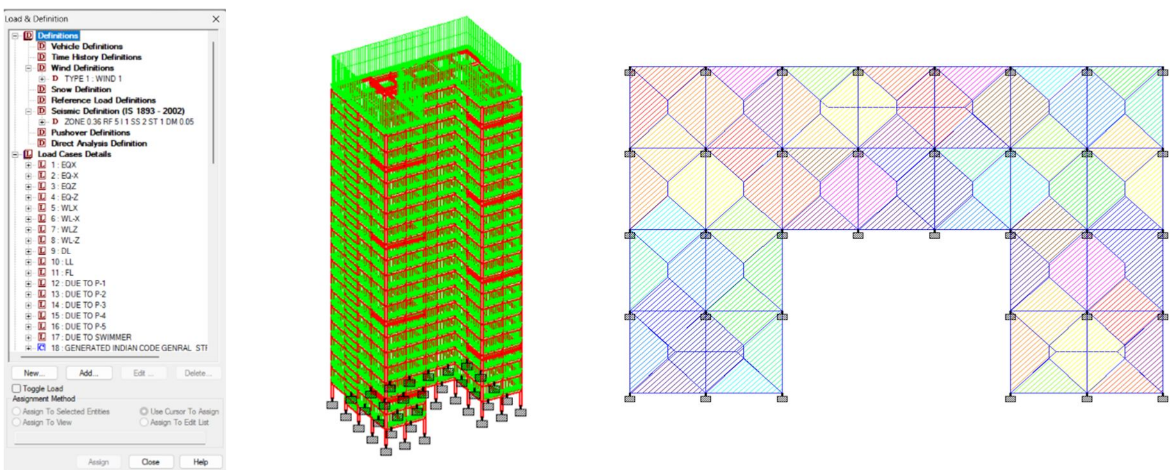

Fig. 12 Shows the application of loads

7) *Load combination.* Load combination is the process of combining different types of loads acting simultaneously on a structure to evaluate the most critical structural response under various possible loading conditions. In structural analysis, a building is subjected to several loads such as dead load, live load, wind load, earthquake load, and special loads such as hydrostatic or equipment loads. Since these loads may act individually or simultaneously, appropriate load combinations are used with specified load factors to account for uncertainties in load magnitude, structural behaviour, and the probability of simultaneous occurrence. Under this shows the combination of loads used as per IS 1893 part-1 2016.

- 1.5 (DL + LL)
- 1.2 (DL + LL ± EQX)
- 1.2 (DL + LL ± EQY)
- 1.2 (DL + LL ± WLX)
- 1.2 (DL + LL ± WLY)
- 1.5 (DL ± EQX)

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- 1.5 (DL ± EQY)
- 1.5 (DL ± WLX)
- 1.5 (DL ± WLY)
- 0.9 DL + 1.2 LL ± 1.2 EQX
- 0.9 DL + 1.2 LL ± 1.2 EQY
- 0.9 DL + 1.2 LL ± 1.2 WLX
- 0.9 DL + 1.2 LL ± 1.2 WLY
-

8) *Design run on model M6 in zone V* After identifying Zone V as the critical seismic zone, the final design was analyzed with additional shear wall and bracing systems. Their effectiveness in reducing storey displacement and drift was evaluated. A comparative assessment was conducted to identify the most structurally efficient and economical strengthening system for achieving better seismic performance and stability.

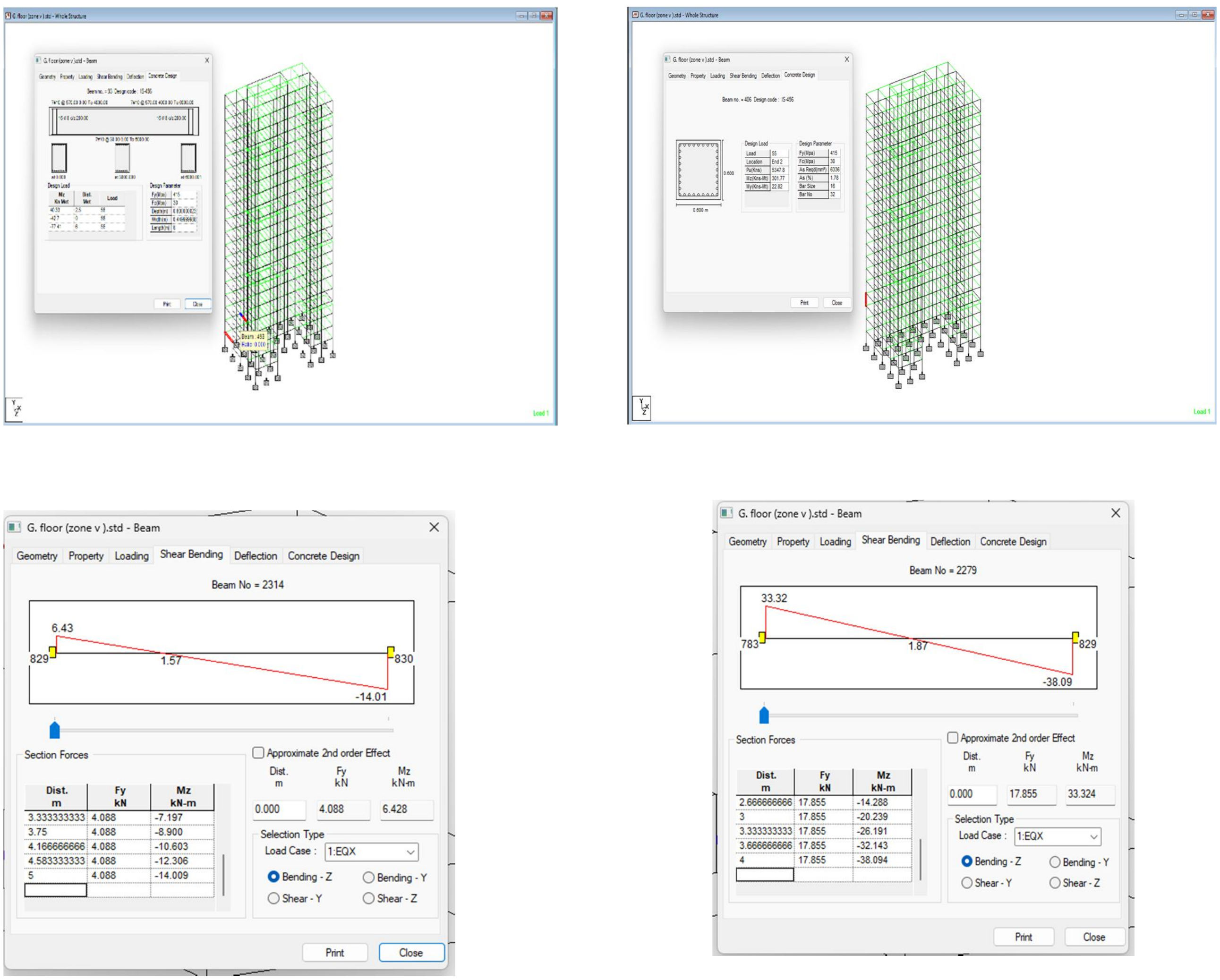


Fig. 13 design of Building

IV. RESULT AND DISCUSSION

The results are presented systematically for the non-floating-column model and floating-column models with columns discontinued at different floor levels. The response under earthquake loading in the principal directions is compared to determine the variation in seismic behaviour. Similarly, wind-load responses are evaluated to assess the influence of the structural configuration on lateral performance. The comparative evaluation of these results forms the basis for determining the most critical structural configuration and the floor level at which the introduction of floating columns produces significant changes in structural response. The findings are subsequently interpreted with respect to the applicable Indian Standards and the structural safety and serviceability requirements adopted for the study.

STOREY DISPLACEMENT X-DIRECTION							
SR.NO	HT.	M1	M2	M3	M4	M5	M6
1	2	1.73	0.635	1.378	1.912	3.327	3.322
2	4	4.782	1.752	3.826	5.342	9.186	9.172
3	8	11.963	4.384	9.572	13.348	22.978	22.947
4	12	18.529	6.796	14.816	20.56	35.591	35.597
5	16	24.842	9.189	19.857	27.47	47.711	48.024
6	20	30.653	11.41	24.532	33.901	58.837	59.381
7	24	38.222	14.247	30.611	42.066	73.297	74.2
8	28	46.435	17.245	37.2	50.667	88.985	89.89
9	32	53.797	19.934	43.096	58.3	103.048	103.971
10	36	60.7	22.516	48.622	65.416	116.229	117.411
11	40	66.761	24.807	53.502	71.741	127.782	129.144
12	44	74.164	27.567	59.454	79.349	141.862	143.555
13	48	81.903	30.374	65.669	87.114	156.576	158.267
14	52	88.729	32.836	71.143	93.944	169.549	171.241
15	56	94.893	35.145	76.082	100.071	181.26	183.122
16	60	99.979	37.081	80.175	105.227	190.91	192.839
17	64	105.612	39.294	84.704	110.884	201.56	203.709
18	68	111.085	41.337	89.1	116.294	211.89	214.036
19	72	115.713	43.04	92.814	120.912	220.616	222.741
20	76	119.536	44.521	95.877	124.67	227.812	229.948
21	80	122.238	45.604	98.042	127.422	232.892	234.909

Table 5 Storey Displacement in X – Direction

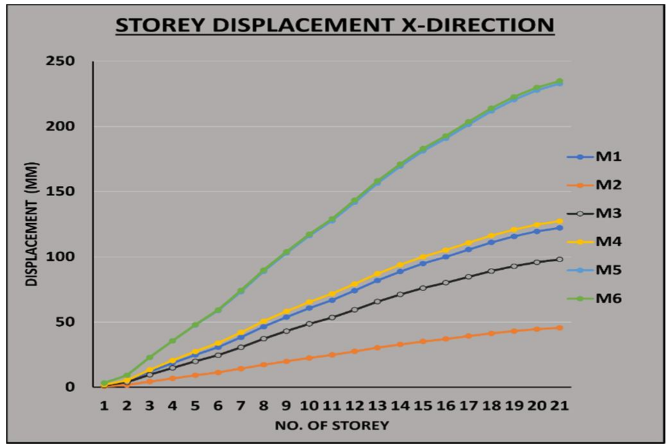


Fig. 14 Graph for Storey Displacement in X – Direction

STOREY DISPLACEMENT Z-DIRECTION							
SR.NO	HT.	M1	M2	M3	M4	M5	M6
1	2	0.022	0.012	0.018	0.035	0.041	0.034
2	4	0.011	0.019	0.012	0.026	0.01	0.026
3	8	0.066	0.099	0.061	0.135	0.013	0.091
4	12	0.207	0.323	0.17	0.418	0.134	0.136
5	16	0.262	0.0516	0.236	0.722	0.101	0.374
6	20	0.275	0.476	0.255	0.717	0.119	0.414
7	24	0.387	[illegible]	[illegible]	.925	0.066	0.567
8	28	0.571	0.776	0.547	1.22	0.017	0.764
9	32	0.789	0.879	0.741	1.46	0.029	0.781
10	36	0.947	0.0935	0.907	1.699	0.015	0.898
11	40	1.013	1.062	0.976	1.927	0.009	1.111
12	44	1.21	1.3	1.173	2.333	0.114	1.416
13	48	1.483	1.562	1.444	2.799	0.259	1.747
14	52	1.758	1.632	1.703	3.113	0.292	1.841
15	56	1.986	1.628	1.935	3.388	0.358	1.962
16	60	2.087	1.823	2.038	3.753	0.37	2.272
17	64	2.332	2.065	2.283	4.289	0.506	2.677
18	68	5.645	2.438	2.595	4.847	0.689	3.092
19	72	2.915	2.505	2.864	5.178	0.814	3.271
20	76	3.175	2.505	3.122	5.454	0.876	3.374
21	80	3.273	2.796	3.219	5.853	0.881	3.681

Vertical (Value) Axis Title

Table 6 Storey Displacement in Z – Direction

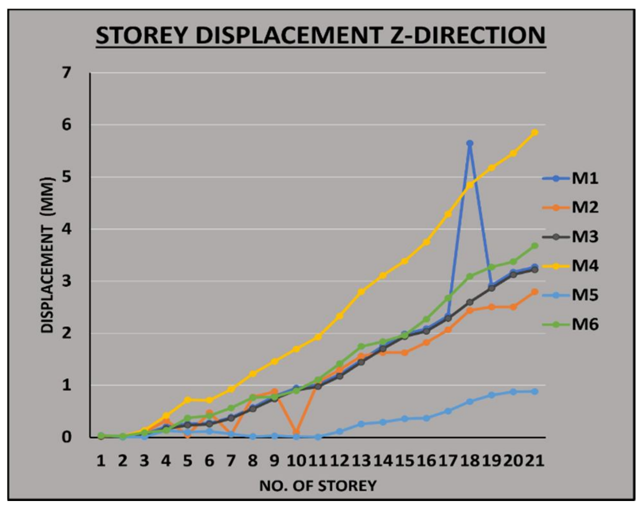


Fig. 15 Graph for Storey Displacement in Z – Direction

A. Discussion

- The graph indicates that M5 and M6 experience substantially higher lateral displacement than the other models, whereas M2 exhibits the lowest displacement. This demonstrates that the structural configuration and the location/arrangement of floating and non-floating columns have a significant influence on the lateral stiffness and displacement response of the C-shaped irregular building.
- The maximum displacement occurs at the top storey in every model, which is expected because lateral deformation accumulates with increasing building height.
- The graph presents the storey-wise displacement in the X-direction for six structural models (M1–M6) of the C-shaped irregular building. The displacement is plotted in millimetres against the number of storeys.

- The progressive increase in displacement towards the upper storeys is particularly evident in M2, M3, M4 and M6. Such behavior indicates that the deformation accumulates as the height of the structure increases. The relatively high displacement observed in M4 suggests that this configuration is more critical from the displacement point of view.
- The sudden peak observed in M1 at the 18th storey is noteworthy. Since the displacement increases sharply and then reduces at the following storey, this behavior should be checked against the corresponding STAAD.Pro node displacement results, load case, member connectivity, column arrangement and floating-column location to ensure that it represents the actual structural response rather than a modelling or output interpretation issue.

STOREY DRIFT X-DIRECTION

SR.NO	HT.	M1	M2	M3	M4	M5	M6
1	2	1.73	0.635	1.378	1.912	3.327	3.322
2	4	3.052	1.117	2.447	3.43	5.859	5.85
3	8	3.692	1.354	2.98	4.219	7.074	7.061
4	12	1.365	0.535	0.843	0.302	2.78	2.93
5	16	0.83	0.037	0.304	0.235	1.856	2.061
6	20	1.072	0.417	1.224	2.484	1.803	1.935
7	24	4.175	1.527	3.455	4.809	7.906	8.12
8	28	4.505	1.629	3.739	5.138	8.533	8.525
9	32	0.407	0.061	1.076	3.215	0.407	0.395
10	36	1.184	0.328	1.811	3.923	1.768	1.697
11	40	3.181	1.17	3.311	5.798	5.689	5.847
12	44	4.573	1.687	3.875	5.334	8.603	8.789
13	48	4.784	1.717	4.061	5.512	9.007	9.009
14	52	3.448	1.184	3.974	7.569	6.164	6.246
15	56	4.318	1.379	4.768	8.27	7.695	7.725
16	60	5.647	2.097	5.6	9.109	10.385	10.496
17	64	4.231	1.351	3.679	5.102	7.929	8.064
18	68	4.222	1.582	3.682	5.084	7.912	7.921
19	72	7.17	2.568	7.284	12.009	13.365	13.518
20	76	7.951	2.809	7.965	12.515	14.717	14.86
21	80	8.106	2.986	7.777	11.905	15.181	15.173

Table 7 Storey Drift in X – Direction

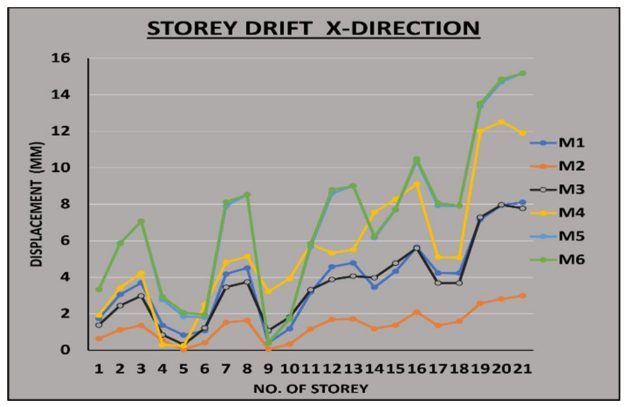


Fig. 16 Graph for Storey Drift in X – Direction

STOREY DRIFT Z -DIRECTION

SR.NO	HT.	M1	M2	M3	M4	M5	M6
1	2	0.022	0.013	0.018	0.035	0.041	0.034
2	4	0.011	0.006	0.006	0.008	0.052	0.06
3	8	0.062	0.019	0.047	0.072	0.2	0.232
4	12	0.093	0.053	0.404	1.305	0.062	0.029
5	16	0.162	0.141	0.571	1.94	0.026	0.071
6	20	0.009	0.002	0.018	0.029	0.138	0.087
7	24	0.022	0.018	0.005	0.002	0.221	0.23
8	28	0.021	0.043	0.003	0.007	0.267	0.309
9	32	2.651	0.937	3.072	6.029	4.568	4.621
10	36	3.061	0.939	3.519	6.657	5.302	5.481
11	40	0.052	0.008	0.059	0.013	0.144	0.062
12	44	0.051	0.113	0.065	0.163	0.218	0.306
13	48	0.047	0.084	0.062	0.11	0.254	0.336
14	52	6.338	2.303	6.591	11.292	11.553	11.639
15	56	6.962	2.226	7.196	11.932	12.668	12.95
16	60	0.089	0.07	0.093	0.02	0.122	0.007
17	64	0.117	0.437	0.125	0.277	0.169	0.306
18	68	0.113	0.093	0.121	0.203	0.185	0.294
19	72	10.396	3.859	10.235	16.213	19.414	19.501
20	76	11.162	3.659	10.91	16.784	20.804	21.102
21	80	0.13	0.044	0.13	0.003	0.092	0.024

Table 8 Storey Drift in Z – Direction

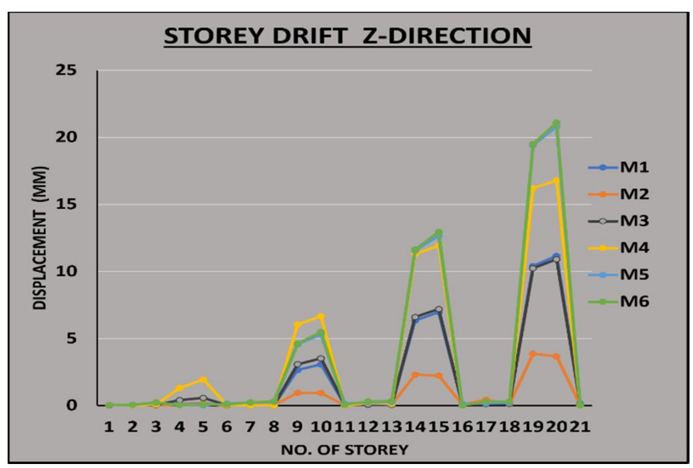


Fig. 17 Graph for Storey Drift in Z – Direction

BASE SHEAR/ TIME PERIOD SA/G					
SR.NO	**MODEL**	**ZONE**	**STRUCTURE**	**BASE SHEAR**	**SA/G**
1	M1	III	WNFC	2649.25	0.678
2	M2	III	WFC	951.95	0.678
3	M3	IV	WNFC	2127.79	0.498
4	M4	IV	WFC	2123.33	0.498
5	M5	V	WNFC	4991.84	0.678
6	M6	V	WFC	4984.49	0.678

B. Discussion

- Based on the maximum values observed from the graph, the approximate order of X-direction displacement is:
  M6 > M5 > M4 > M1 > M3 > M2
- The higher displacement in M5 and M6 indicates that these configurations are more flexible and experience greater lateral deformation under the considered loading condition. The relatively high response at the upper storeys is particularly important because lateral deformation tends to accumulate with increasing structural height.
- The sudden variations observed around storeys 7–9, 12–14 and 18–21 may be associated with changes in the structural configuration and the presence/location of floating columns. Such discontinuities can modify the stiffness and load-transfer mechanism of the structure and consequently produce variations in lateral displacement.
- Model M3 has a relatively lesser displacement. Maximum displacement is around 98mm. The minimum displacement is observed in Model M2 having maximum displacement of about 45 mm at 21st level. The graphical results thus show the minimum lateral deformation in M2 and the maximum lateral deformation in M5 and M6.

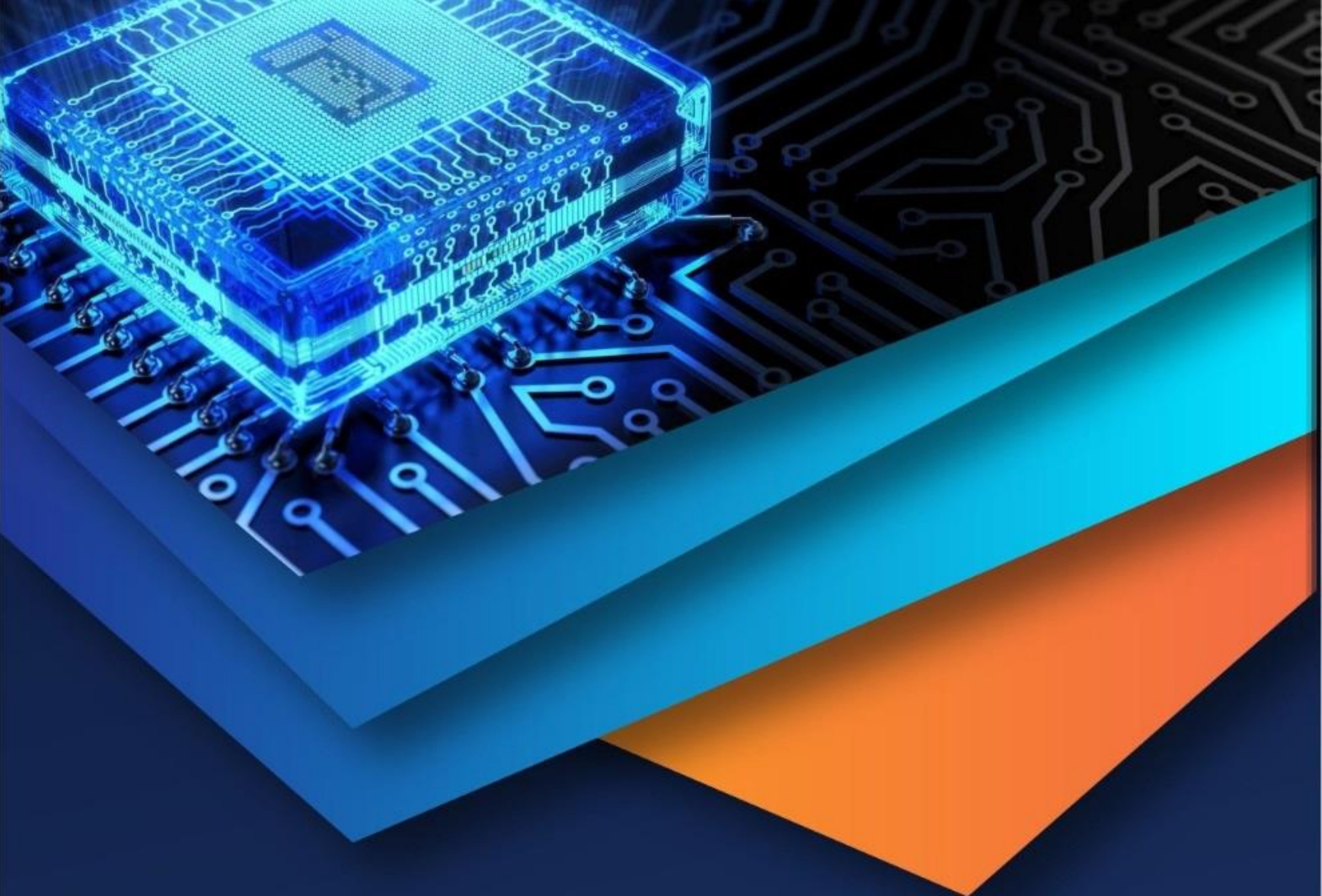
V. CONCLUSION

1) All the analysed building models satisfy the permissible limits of storey displacement and inter-storey drift under the considered seismic loading conditions. It can be observed that the lateral deformation behaviour of the models is acceptable.
2) The higher the seismic zone class, the greater the storey displacement. The buildings exposed to higher seismic zone factors comparatively showing higher lateral displacement than the lower seismic zones.
3) The placement of floating columns has a great impact on the behaviour of the structure. Different patterns of displacement and drift are obtained for floating columns provided at different floor levels. This implies that the position of floating columns should be given due consideration in structural planning and design.
4) The results indicate that the lateral displacement generally increases with the increase in storey height, although fluctuations are observed at certain intermediate storeys due to variations in structural stiffness and configuration. Among the investigated models, M6 exhibits the maximum displacement, reaching approximately 15.2 mm at the 21st storey, followed closely by M5 with a displacement of approximately 15 mm. Model M4 also shows a comparatively higher displacement response, reaching approximately 12.5 mm around the upper storeys. In comparison, M1 and M3 exhibit moderate displacement responses of approximately 8.0 mm and 7.8 mm, respectively, at the uppermost storey.
5) The design runs for Models M5 and M6 were carried out to evaluate their structural performance and associated construction costs.

REFRENCES

[1] Prof. Sarita Singla, Er. Ashfi Rahman (IJERT) (2015) “Effect of Floating Columns on Seismic Response of Multi-Storeyed RC Framed Buildings” Vol. 4 Issue 06.
[2] Arpit Shrivastav, Aditi Patidar (SSRG - IJCE) (2018) “Seismic Analysis of Multistorey Buildings having Floating Columns” Volume 5 Issue 5.

[3] Akash Agrawal, Anurag Wahane (IRJET) (2020) "Analysis of Elevated Swimming Pool with Different Positions on the Terrace of RCC Frames using STAAD Pro." Volume: 07 Issue: 09.
[4] Rashmi Agashe, Marshal Baghele, Vaishanvi Deshmukh, Sharad Khomane, (IRJET) (2020) "To Study Analysis and Design of Multi-Storey building using STAAD-pro. and Comparing with Manual Calculations" Volume: 07 Issue: 04.
[5] Divya Nayak, Shubham Dashore. (JETIR) (2023) "Review on Structural Analysis of Building Structure with Floating Column" Volume 10, Issue 5.
[6] IS: 875 (Part I) – 1987, "Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures", Part 1 Dead Loads - Unit Weights of Building Materials and Stored Materials, Second Revision, September 2003.
[7] IS: 875 (Part 2) – 1987, "Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures", Part 2 Imposed Loads, Second Revision and June 1998.
[8] IS CODE 456-2000. RCC design
[9] IS 1893 -2016 (PART -1) Criteria for Earthquake resistance design of structure
[10] IS: 875(Part3): Wind Loads on Buildings and Structures -Proposed Draft & Commentary



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