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SEISMIC ANALYSIS OF RCC BUILDING WITH AND WITHOUT FLOATING COLUMN USING STAAD PRO V8i

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Abstract

Ground vibrations may cause moderate to severe damage to many reinforced concrete structures in metropolitan areas that are located in active seismic zones. Architectural design and the frame drawing of a structure with floating columns are the focus of this project. The consequences of the load distribution on the floating columns are also being examined. The path of action of force is also examined for its significance and impacts. We're comparing the seismic analysis of multistory buildings with and without floating columns in this research. STAAD Pro V8i is being used to do an analogous static analysis on the whole mathematical 3D model of the project and the resulting models are being compared. Floating columns are used in many structures, particularly those above ground level, to provide additional open space for parking and other purposes.

Keywords: Floating Column, Multistorey Buildings, STAAD PRO V8i, seismic.

1. INTRODUCTION

Several structural design rules seem to be concerned with preventing or mitigating progressive collapse. Structures need to be strong enough, flexible enough, and redundant enough to compensate for the danger of disproportional failure.

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Analytical methodologies such as linear static, nonlinear static, and linear dynamic are all options in the alternative load route approach. In linear static analysis, the whole factored load is applied simultaneously to the damaged structure. The damage zone's size may be calculated using the DCR (Demand capacity ratio) after the static analysis. Structure elements and joints connections with DCR values less than 2 are inconvenient if the structure has a lot of fractures and damage, in which case a different solution is better. This approach is simple, quick, and can only be used for buildings with a maximum of ten storeys, making it ideal for smaller projects. To account for the material and geometric nonlinearity, nonlinear static analysis is a time-consuming process that requires iteration. Because of these differences in material and shape, nonlinear dynamic analysis is used to describe the structure's real behaviour while undergoing inelastic deformation, whereas linear dynamic analysis is used to analyse the structure's load history from zero to full factored load put on it.

1.1. Progressive Collapse

When a modest or local structural failure leads to the deterioration and failure of adjacent elements, this is considered a progressive collapse, which may lead to the complete collapse of a structure (or at least an unreasonably significant piece of it). Building structures begin to decompose when one or more vertical load-bearing components, often columns, are lost. To distribute the load after one or more columns have collapsed, an alternate load channel must be devised. Failure will occur if the neighbouring components are not intended to withstand the redistributed loads, resulting in partial or complete collapse of the structure.

Progressive collapse is a highly nonlinear dynamic event that involves the whole structural system, making the process incredibly intricate. Hand-calculations and basic analytical approaches are ineffective in investigating the process, if not impossible. Computational models of progressive building collapse have become the dominant method for investigating this phenomenon because of the high cost, complexity, and danger of conducting practical experiments. More high-quality experimental findings that may be utilised for model validation, on the other hand, are required in order to increase the accuracy and dependability of the computational models.

There are three ways to mitigate progressive collapse in a design strategy for progressive collapse. The following is the progression of this classification:

(a) Specific local resistance;
(b) Alternate load path method;
(c) Prescriptive design rules.

Direct approaches (a and b) and indirect approaches (c) are used interchangeably. The Alternate Load Path Method (APM) involves constructing the structure such that stresses may be reallocated after the loss of a vertical bearing part. Alternate load routes, from static linear to static nonlinear to dynamic linear or nonlinear, may be accounted for in the design process by adopting various degrees of idealization.

Pressure Loads

1. Internal gas explosions

2. Blast
3. Wind over pressure
4. Extreme values of environmental loads

Impact Loads

1. Aircraft impact
2. Vehicular collision
3. Earthquake
4. Overload due to occupant overuse
5. Storage of hazardous materials

1.2. Progressive Collapse Guidelines

Criteria defined by the "American Society of Civil Engineers (ASCE)", as well as the GSA, DFA, and NIST, have been used to analyse, design, and enhance the structural integrity of both existing structures as well as new construction. Load combinations with anomalous loads and their corresponding probability are provided by ASCE. It also discusses generic methods for ensuring structural integrity if a major load-carrying element is damaged. Following ASCE 7 recommendations, the test building's collapse resistance is tested in this article using suggested load combinations.

Existing structures may be evaluated against progressive collapse using GSA principles, and new structures can be designed using these rules as well. For structures with relatively simple layouts and a maximum of ten floors above ground, a simplified threat independent technique is advised. To perform a linear elastic static analysis of the structure, an immediate removal of a first-story column positioned near the building's corner is needed. The computed demand-to-capacity ratio (DCR) for each structural member is used to analyse the progression of collapse and likely future failure of components. the moment, shear, and axial forces determined after a column's loss and the member's capacity are specified as the DCR ratio.

1.3. Shear Wall in RCC Building

An example of a shear wall would be a vertical element that can withstand a combination of lateral load transfer from another structural part to the wall, as well as the axial load produced by gravity. The typical need for multi-story buildings is RCC walls, including shear walls. When designing a structure, it's preferable if the building's mass centre and its centroid coincide. It is the most effective way to stiffen a building's structural system since the primary purpose of a shear wall is to enhance the building's lateral load resistance. Cross-sections of Shear walls are available in a variety of forms and sizes, including rectangular, T, L, barbell, and box cross-sections. If you're creating a service apartment or office/commercial tower, shear wall structures are becoming more popular. Using a shear wall system for a 30-35-story structure has been shown to be an effective structural technique.

To withstand horizontal earthquake stresses, shear walls must have sufficient lateral strength. These horizontal forces will be transferred to the next segment of the load path below shear walls once they're strong enough to do so. Other shear walls, floors, foundation walls, slabs, and footings are also included in the load path. To avoid excessive side-sway on the roof or floor above, shear walls provide lateral rigidity. Floor and ceiling framing members will no longer be able to defy the shear walls if they're rigid enough. The non-functional damage to a structure may be reduced if it is sufficiently rigid.

2. LITERATURE REVIEW

Samrat Prakash Khokale (2017) discovered the building's most crucial Shear wall, which will cause the most damage or collapse if it is removed. Studying Shear wall's shear strength is the most important component. After that, the same programme is used to examine the building's collapse pattern. An anomalous loading-induced progressive collapse may be avoided by following current design principles described in the U.S. and European building codes and standards presented in this study. It is difficult to define abnormal loading, thus design provisions focus on ensuring that structures are strong, flexible, and redundant in the event of an abnormal load.

MD Goel et al (2017) A four-story RCC structure with 3 x 3 bays and a longitudinal bay span of 5 metres and a transverse bay span of 4 meters has been investigated by my team. Each storey of the building is 3.5 m high, except for the lowest floor, which is 4 m high. It has been determined that the rapid collapse of a load-bearing part has caused behavioural alterations.

P.P Chandurkar (2013) In order to establish the best placement for the shear wall in a multi-story structure, we used four distinct models to conduct a detailed research. ETAB Nonlinear v 9.5.0 was used to model the buildings. After examining ten-story buildings in seismic zones II, III, IV, and V, researchers discovered that shear walls with short spans at corners (model 4) are more cost-effective than other models in terms of lateral displacement, storey drift, and overall ground-floor costs. Shear walls have been shown to be cost-efficient and effective in high-rise structures, and their placement significantly lowers earthquake displacement. If the shear wall's dimensions are substantial, the shear wall absorbs the majority of horizontal forces.

Meng-Hao Tsai (2011) It was found that three prevalent forms of outside non-structural RC walls have an impact on the RC frame's progressive collapse potential. Static evaluations of the RC frames with and without non-structural walls are performed in three distinct column loss situations using linear and nonlinear methods. It is possible to overestimate beam moment demand without taking into account non-structural walls and underestimate shear demand, particularly for panel-type walls, based on demand-to-capacity ratios. They may improve the building's resistance to collapse if a column is lost, but at the expense of ductility. From a structural standpoint, the wing-type outer wall is superior than the parapet-type and panel-type walls because it has a constant opening rate of 60%. Shear failure of the connecting beam members of the panel-type wall looks to be the worst option.

Leslaw Kwasniewski (2010) provided a case study of a multi-story building's progressive collapse analysis. An 8-story steel-framed building used for fire testing at the Cardington Large Building Test Facility in the UK is the topic of the numerical analysis. Nonlinear dynamic finite element simulations are used to analyse the issue in accordance with GSA recommendations. Global models with increased vertical loads and the elimination of notional columns will be the focus of this research. Multiprocessor computers were used to create a 3D model with many finite components of the structure, taking use of their parallel processing capabilities. Proposed hierarchical verification and validation procedures are intended to reduce the level of uncertainty associated with the final conclusion (potential for progressive collapse) of the feasibility study.

3. METHODOLOGY

3.1. Design Parameters

In order to design in accordance with IS 13920, a number of parameters are included in the software. It accepts all of the parameters required to design in accordance with IS: 456. In addition, it contains a few extra criteria that are only necessary if the design is carried out in accordance with IS: 13920. We chose the default parameter values based on their frequency of usage in standard standards for traditional design. All accessible parameters and their default values are shown so that they may be customised to meet the needs of the specific design being carried out. Before beginning the concrete design, you must provide the units of length and force as millimetres and newtons, respectively.

3.2. Beam Design

Flexure, shear, and torsion are the primary functions of beams. The axial force may be taken into account if necessary. Pre-scanning of all active beam loadings identifies the critical load instances at various parts of the beams for all of the forces. The width of the member must not be less than 200mm in order for the design to be done in accordance with IS: 13920. The member's width-to-depth ratio should be greater than 0.3.

Design for Flexure:

IS 456's design process is the same as this one. However, according to IS-13920, the following requirements must be met throughout the design process:

1. The minimum concrete grade should be M20 at a minimum.
2. Fe415 or lower steel reinforcements must be utilised.
3. The minimum tension steel ratio on any face, at any section, is determined as follows:

$\rho_{min} = 0.24\sqrt{f_{ck}}/f_y$

4. Steel ratio max = 0.025 defines the maximum steel ratio on any face, at any section.
5. At a minimum, the positive steel ratio at a joint face must be equal to half the negative steel ratio at that face.
6. There must be a minimum of one-fourth of the maximum negative moment steel supplied at each joint face in the steel given at each section's top and bottom faces, respectively.

Design for Shear

In determining the shear force that vertical hoops must withstand, the IS 13920:1993 version is used. When calculating the shear force, elastic sagging and hogging moments of resistance of the beam section at the ends are taken into account. If the PLASTIC parameter is included in the input file, plastic sagging and hogging moments of resistance may also be considered for shear design. Reinforcement designed to withstand shear and torsion is known as “shear reinforcement”.

3.3. Column Design

According to IS 456:2000, columns are intended to withstand axial forces and biaxial moments. Shear forces may also be applied to columns. STAAD's column design has addressed all of the primary criteria for choosing longitudinal and transverse reinforcement outlined in IS: 456. The following conditions, however, must be met in order for IS 13920 to be implemented:

1. M20 is the recommended minimum concrete grade.
2. Fe415 or lower steel reinforcements must be utilised.
3. Column members must not be less than 200 mm in diameter. It is not permitted to have columns with an unsupported length of less than 4 metres.
4. A ratio of not less than 0 is preferred for the shortest cross-sectional to perpendicular dimension.
5. Except if extra restricting reinforcement is supplied, the minimum lateral dimension of the column's hoops cannot be exceeded by more than half.
6. Over a length lo from each joint face toward mid-span and on each side of any section where flexural yielding may occur, special confining reinforcement should be supplied. Lo must not be less than a greater lateral dimension of the member at the section where yielding occurs, b) one-sixth of the clear span of the member, and c) the length of the clear span of the member.
7. Hoops used as specific confining reinforcement must not be less than 75 mm in diameter or more than 100 mm in diameter.

3.4. Design Operations

STAAD provides a wide range of tools for developing structural elements as part of a larger structure that is being analysed. These features allow the user to do many design processes. The design of these facilities might be a concern. A design includes the following steps:

- Identify the components and load scenarios that will be taken into account throughout the design process.
- Code checking or member selection may be selected.
- To customise the default settings, enter the values for the design parameters you want to use.
- Specify whether member selection is to be done via optimization.

These operations may be repeated by the user any number of times depending upon the design requirements.

4. RESULTS AND DISCUSSION

A RCC building is designed according to Indian code. We have considered 4 storey building along having floor height of 3.2 m and the depth of foundation is to be 1.5 m. The combination of both the Loads is considered according to Indian standards code IS 456. Concrete grade considered is M25 and steel grade Fe 415. The exterior column of ground floor is removed one by one in a series to find out the critical columns. Comparative study of various parameters like axial forces on column, node displacement at top nodes of removed column and support reactions in vertical direction of both the frame (with and without shear wall) is carried out

4.1. DETERMINATION OF CRITICAL COLUMN AT GROUND FLOOR OF RCC BUILDING

The numbering of columns on the ground level is shown in the figure. The exterior column of a four-story structure is subjected to a series of column removal scenarios to identify the most crucial columns on the bottom level. STAAD Pro's remove command is used for each external column removal scenario on the bottom level.

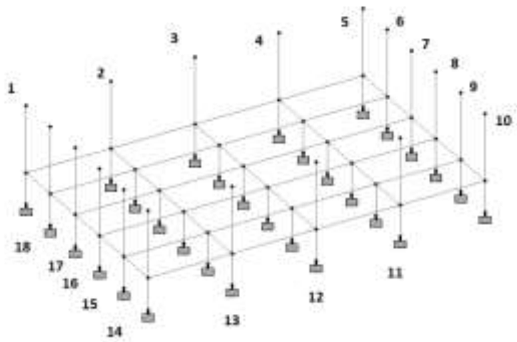

Figure 1: Numbering of columns of ground floor

4.2. When no collapse in column

When no collapse in beam the table shows the forces in each point the maximum axial force is 1299.914 KN and minimum axial force is -141.457. in shear force in y-direction and z-direction case the maximum value is 293.036KN for y-direction and 293.036 is x-direction and minimum value is -293.036 in y-direction and -114.087 is z-direction. In case of banding moment the value in minimum and maximum value in x-direction is 821.869 and -821.868KN, y-direction banding moment maximum and minimum value is 2008.613KN and -1973.064KN respectively and z-direction bending moment maximum and minimum value is 6063.021 and -4920.402KN respectively.

Beam	Node	Axial Force (KN)	Shear force (KN)		Bending moment (KNm)		
		Fx	Fy	Fz	Mx	My	Mz
206	103	1299.914	40.282	2.711	-0.764	1.305	-13.1827
246	131	-141.457	31.156	-0.864	0.195	1.581	22.092
159	62	309.064	293.036	-10.866	1.390	14.419	381.760
158	61	309.064	-293.036	-10.866	-1.390	14.419	-381.760
170	73	260.703	-28.690	114.977	0.825	140.975	36.083
171	74	261.343	-30.073	-114.087	36.083	142.143	
174	77	22.564	97.552	7.812			
184	85	22.564	75.335	-7.812			
170	91	248.971	-28.690	114.977			
171	92	249.610	-30.073	-114.087			
135	61	-115.952	224.304	0.000			
159	80	297.331	293.036	-10.866			

When no collapse in beam the table shows the displacement in each point in x-direction the maximum displacement is 0.059 KN and minimum displacement is -0.059. displacement in y-direction and z-direction case the maximum value is 0.001 for y-direction and 0.017 is z-direction and minimum value is –0.206 in y-direction and -0.001 is z-direction. In case of rotational displacement the value in minimum and maximum value in rx-direction is 0.005 and -0.005, ry-direction rotational displacement maximum and minimum value is 0 and rz-direction rotational displacement maximum and minimum value is 0.040 and -0.040 respectively.

All | Summary

	Node	L/C	Horizontal X in	Vertical Y in	Horizontal Z in	Resultant in	Rotational rX rad	rY rad	rZ rad
Max X	85	3 Generated l	**0.059**	-0.206	0.000	0.214	0.000	-0.000	-0.040
Min X	86	3 Generated l	**-0.059**	-0.206	0.000	0.214	0.000	0.000	0.040
Max Y	90	2 LIVE	0.000	**0.001**	-0.016	0.016	-0.000	-0.000	-0.000
Min Y	86	3 Generated l	-0.059	**-0.206**	0.000	0.214	0.000	0.000	0.040
Max Z	87	3 Generated l	0.004	-0.170	**0.017**	0.171	0.005	-0.000	0.004
Min Z	90	3 Generated l	0.000	-0.020	**-0.043**	0.047	-0.001	0.000	-0.000
Max rX	91	3 Generated l	-0.004	-0.170	0.017	0.171	**0.005**	0.000	-0.004
Min rX	92	3 Generated l	-0.004	-0.167	-0.012	0.168	**-0.005**	-0.000	-0.004
Max rY	77	3 Generated l	-0.011	-0.142	-0.001	0.142	-0.001	**0.000**	0.009
Min rY	76	3 Generated l	0.011	-0.142	-0.001	0.142	-0.001	**-0.000**	-0.009
Max rZ	80	3 Generated l	-0.059	-0.206	0.002	0.214	-0.000	-0.000	**0.040**
Min rZ	79	3 Generated l	0.059	-0.206	0.002	0.214	-0.000	0.000	**-0.040**
Max Rs	85	3 Generated l	0.059	-0.206	0.000	**0.214**	0.000	-0.000	-0.040

Table 1: Column 1, 4, 8, 12, 16, 18 is removed

Removal of column	Adjacent column	Axial forces before removal	Axial forces after removal
1	2	349.63	529.67
4	3	64.03	71.69
4	5	274.25	539.35
8	7	298.94	435.18
8	9	407.91	543.5
12	11	337.95	401.90
12	13	337.95	362.83
16	15	407.91	556.64
16	17	298.94	1190.94
18	17	407.83	1190.94

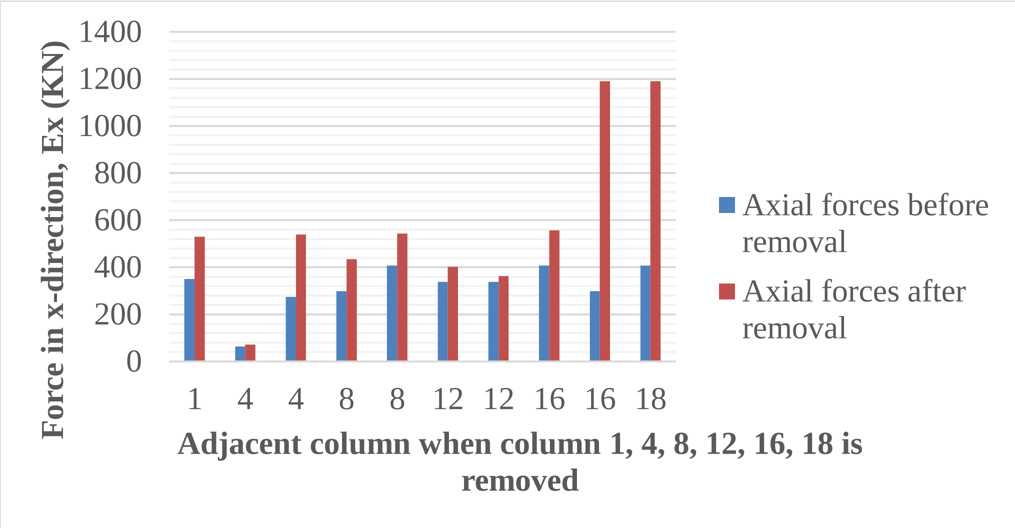

Fig. 2: Comparison of Axial forces in columns of GF

Table 2: Reaction force before column removal and after column removal

Removal of column	Adjacent column	reaction forces before removal	Reaction forces after removal
1	2	382.94	566.62
4	3	69.23	79.96
4	5	288.94	560.28
8	7	323.36	453.15
8	9	430.18	561.09
12	11	360.77	424.2

12	13	109.86	380.16
16	15	430.18	578.13
16	17	323.36	1201.56
18	17	430.02	1201.56

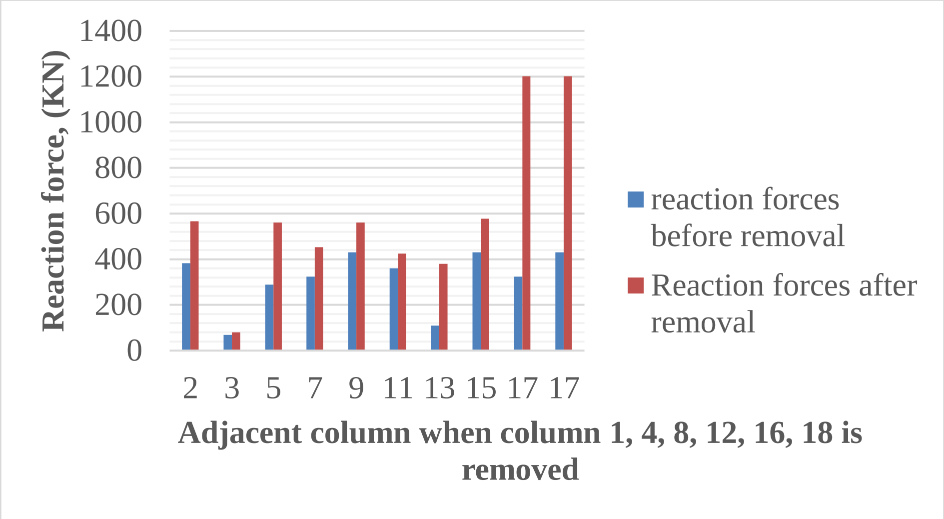

Figure 3: Comparison of reaction force before and after removal

Table 3: Reaction force in y-direction before column removal and after column removal

Removal of column	Adjacent column	Fy before removal	Fy after removal
1	2	0.412	1.773
4	3	0.000	-0.331
4	5	6.050	29.011
8	7	28.34	24.90
8	9	34.09	30.51
12	11	-3.014	-10.78
12	13	3.014	-10.06
16	15	-34.09	-42.54
16	17	-28.34	-39.36
18	17	-3409	-39.36

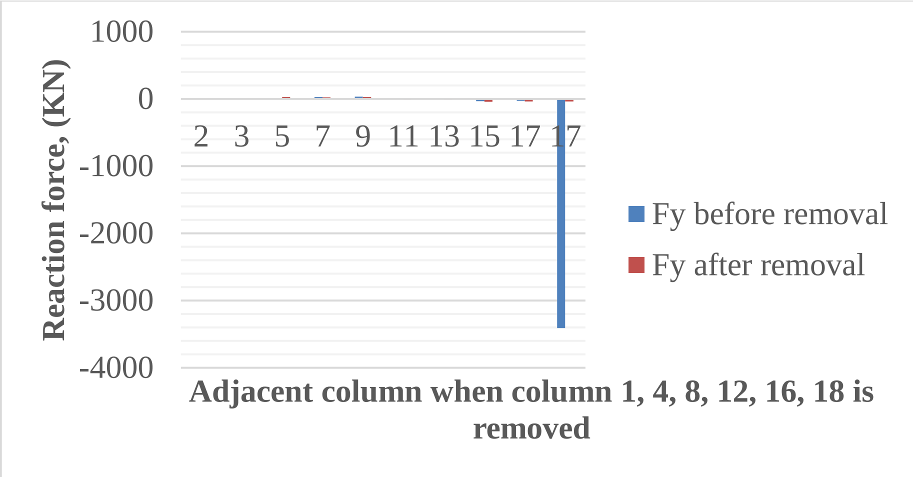

Figure 4: Fy before and after removal

Table 4: Reaction force in z-direction before column removal and after column removal

Removal of column	Adjacent column	Fz before removal	Fz after removal
1	2	12.404	14.43
4	3	2.207	6.741
4	5	2.060	6.776
8	7	-0.309	13.63
8	9	1.013	2.563
12	11	-12.18	-11.14
12	13	-12.18	-9.495
16	15	1.013	-3.786
16	17	-0.309	-24.25
18	17	-0.998	-24.25

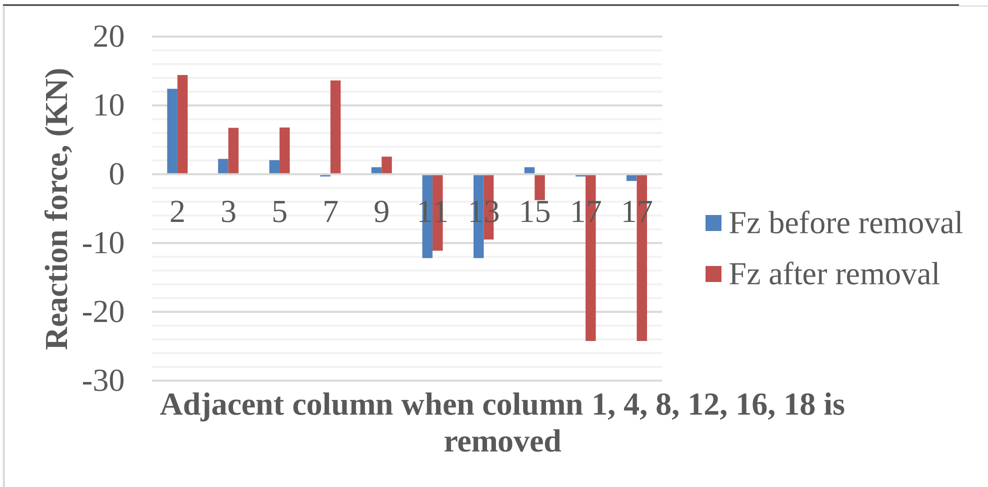

Figure 5: Fz before and after removal

Table 5: Moment force in x-direction before column removal and after column removal

Removal of column	**Adjacent column**	**Mx before removal**	**Mx after removal**
1	2	-1.212	-6.315
4	3	0.000	21.611
4	5	0.231	24.75
8	7	0.135	-0.970
8	9	0.057	3.082
12	11	-0.881	1.488
12	13	0.881	1.057
16	15	-0.057	-3.859
16	17	-0.135	0.437
18	17	0.037	0.437

Table 6: Moment force in y-direction before column removal and after column removal

Removal of column	Adjacent column	My before removal	My after removal
1	2	-84.26	-270.33
4	3	-15.53	-188.012
4	5	-17.70	-124.64
8	7	3.560	-181.89
8	9	-7.551	-108.08
12	11	82.168	-38.78
12	13	82.168	-110.87
16	15	-7.551	-135.74
16	17	3.560	25.81
18	17	7.393	25.81

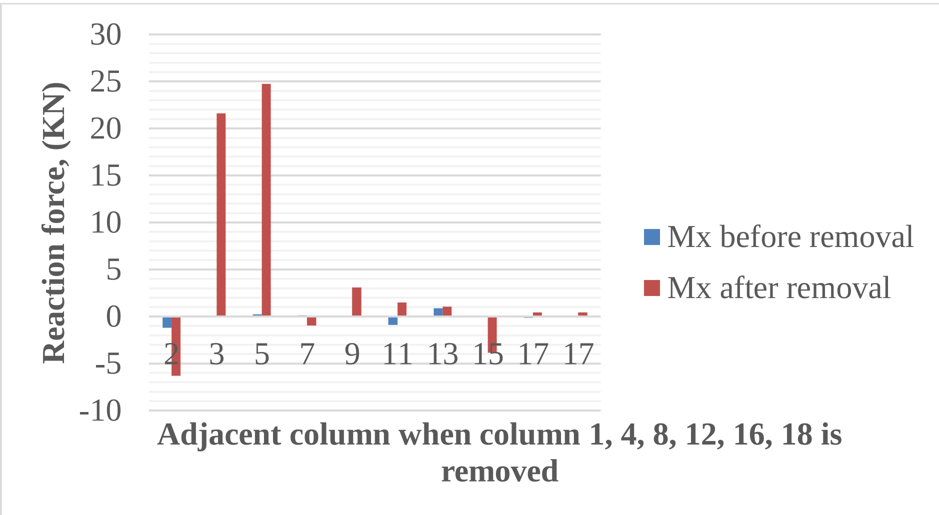

Figure 6: Mx before and after removal

Table 7: Moment force in z-direction before column removal and after column removal

Removal of column	Adjacent column	Mz before removal	Mz after removal
1	2	-21.41	-81.12
4	3	0.000	-19.93
4	5	49.95	157.22
8	7	226.75	108.29
8	9	274.79	166.14
12	11	-25.02	-174.01
12	13	25.02	-166.45
16	15	-274.79	-428.07
16	17	-226.75	-416.68
18	17	-274.23	-416.68

Table 8: Displacement in x-direction before column removal and after column removal

Removal of column	Adjacent column	Node	node displacement in x-direction before removal	node displacement in x-direction after removal
1	2	13	0.000	0.019
4	3	17	0.000	0.003
4	5	4	-0.008	-0.015
8	7	8	0.008	0.001
8	9	12	0.009	-0.008
12	11	20	0.001	-0.027
12	13	14	-0.001	-0.029
16	15	11	-0.009	-0.026
16	17	9	-0.008	-0.014
18	17	5	-0.009	-0.014

Table 9: Displacement in y-direction before column removal and after column removal

Removal of column	Adjacent column	Node	node displacement in y-direction before removal	node displacement in y-direction after removal
1	2	13	-0.01	-0.015
4	3	17	-0.002	-0.002
4	5	4	-0.008	-0.015
8	7	8	-0.008	-0.012
8	9	12	-0.011	-0.015
12	11	20	-0.009	-0.011
12	13	14	-0.009	-0.01
16	15	11	-0.011	-0.015
16	17	9	-0.008	-0.032
18	17	5	-0.011	-0.032

Table 10: Displacement in z-direction before column removal and after column removal

Removal of column	**Adjacent column**	**Node**	**node displacement in z-direction before removal**	**node displacement in z-direction after removal**
1	2	13	-0.002	-0.017
4	3	17	0.000	-0.005
4	5	4	0.000	-0.01
8	7	8	0.000	-0.01
8	9	12	0.000	-0.009
12	11	20	0.002	0.01
12	13	14	0.002	-0.003
16	15	2	0.000	0.000
16	17	9	0.000	0.002
18	17	5	0.000	0.002

Note: displacement in x,y,z direction are in inches convert it into mm when collapse

All Summary Envelope

	Beam	L/C	Node	Fx kN	Fy kN	Fz kN	Mx kip-in	My kip-in	Mz kip-in
Max Fx	202	3 Generated	99	**3615.616**	60.858	2.564	11.512	55.778	-174.574
Min Fx	178	3 Generated	81	**-309.785**	230.637	39.315	82.700	-285.415	2211.452
Max Fy	159	3 Generated	62	323.949	**293.667**	3.479	-157.666	-29.426	3333.641
Min Fy	49	3 Generated	27	326.411	**-497.209**	25.150	-373.915	91.725	4670.042
Max Fz	162	3 Generated	65	22.162	-255.259	**130.963**	-129.277	-1616.012	-2840.633
Min Fz	74	3 Generated	25	72.389	-272.181	**-294.590**	-99.051	4819.469	-4491.450
Max Mx	172	3 Generated	75	-2.101	-3.564	62.205	**1062.049**	-832.337	-742.931
Min Mx	184	3 Generated	85	-67.145	199.949	19.927	**-769.486**	49.476	1211.958
Max My	74	3 Generated	25	72.389	-272.181	-294.590	-99.051	**4819.469**	-4491.450
Min My	158	3 Generated	79	30.416	-303.763	-244.295	-175.117	**-3977.905**	5039.723
Max Mz	135	3 Generated	61	-128.716	227.177	-3.315	-41.634	234.135	**6264.044**
Min Mz	159	3 Generated	80	312.217	293.667	3.479	-157.666	69.097	**-4983.654**

			Horizontal	Vertical	Horizontal	Resultant	Rotational		
	Node	L/C	X in	Y in	Z in	in	rX rad	rY rad	rZ rad
Max X	4	3 Generated	**0.071**	-0.044	-0.032	0.090	-0.001	-0.000	-0.003
Min X	78	3 Generated	**-6.318**	-0.266	-1.163	6.430	-0.001	0.003	0.044
Max Y	90	2 LIVE	-1.125	**0.048**	-0.871	1.423	-0.002	-0.003	0.001
Min Y	91	3 Generated	-6.304	**-9.584**	-1.722	11.600	-0.002	-0.003	0.019
Max Z	7	3 Generated	-0.043	-0.095	**0.006**	0.105	0.000	-0.000	0.004
Min Z	75	3 Generated	-6.269	-5.117	**-4.297**	9.162	-0.013	0.003	0.015
Max rX	37	3 Generated	-0.426	-9.579	-0.300	9.594	**0.000**	-0.000	0.019
Min rX	25	3 Generated	-0.822	-3.468	-0.328	3.579	**-0.020**	-0.003	-0.026
Max rY	82	3 Generated	-4.967	-0.205	-1.162	5.105	0.000	**0.009**	0.047
Min rY	90	3 Generated	-3.327	-0.437	-2.475	4.170	-0.006	**-0.007**	0.002
Max rZ	80	3 Generated	-5.780	-0.218	-1.162	5.899	-0.002	0.008	**0.057**
Min rZ	85	3 Generated	-3.549	-0.275	-4.259	5.551	-0.008	0.005	**-0.035**
Max Rs	91	3 Generated	-6.304	-9.584	-1.722	**11.600**	-0.002	-0.003	0.019

5. CONCLUSION

A building with floating columns is structurally inferior than a structure without floating columns. The structure must be able to endure seismic loads if the area of failure is stiffened. There is, however, an increase in the demand for steel and cement.

The fundamental objectives of this study are to improve seismic performance and correctly design floating column-based structures. Open ground floor (stilt floor) in badly damaged or collapsed R.C. buildings generated a "great irregularity of rapid change in stiffness" between ground and upper floors because infilled brick walls increased the lateral stiffness of the frame by a factor of three to four times. An earthquake causes the building to sink roughly one-and-a-half feet in the soft floor due to soil liquefaction. A bulge formed in this road because to the flow of dirt. The raft's base lifted above the water's surface as the structure's rigid body swung to one side. Accordingly, it is recommended that the "soft" floor should fall and do more harm than the upper levels. Buildings on stilts have become more common in order to fulfil the growing need for parking.

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