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Seismic Analysis of Multi Storey Reinforced Concrete Buildings with Floating Column

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ABSTRACT:The Shakes in different region of the planet showed the hazardous outcomes and shortcoming of lacking plans. In current circumstance structures with floating section is an ordinary part in the high level multistory improvement in metropolitan India. The floating fragment is a vertical part which at its lower level lays on a bar. The seismic dormancy powers delivered at its floor levels in a design ought to be carried down along the level to the ground and any deviation or irregularity in this load move way achieves dreary appearance. Thusly components, for instance, floating segments are significantly undesirable in structures worked in seismically dynamic district. Present audit checks out at the ominous effect of the floating portions in building. Models of the packaging are made for multi-story RC structures with and without floating sections to finish close to examination of fundamental limits like typical period, base shear, and even expulsion under seismic excitation. Results procured depicts that the elective extent of giving sidelong setting to lessen the equal distortion, should be taken. The RC working with floating segment directly following giving level setting is bankrupt down. A general examination of the results got is finished for all over three models. The construction with floating fragments ensuing to giving bracings showed moved along seismic execution

KEYWORDS:Floating Column, Seismic Response, Bracings

I. INTRODUCTION

India is an arising country, where urbanization is at the speedier rate in the country including embracing the strategies and sort of creating structures which is under massive progression in the past two or three numerous years. As a piece of urbanization multi-story structures with compositional complexities are created and have open first story as a certain part. This is essentially being embraced to oblige halting or assembling doorways in the essential story as shown in fig.1.1.

The approach to acting of a design during shakes depends fundamentally upon its general shape, size and estimation, despite the way that the seismic quake powers are passed on to the ground. However without a doubt the seismic base shear as experienced by a design during a tremor is likely to its not unexpected period, the seismic power scattering is dependent upon the allocation of solidness and mass along the level and these powers are expected to have been carried down along the level to the ground by the most concise way; any deviation or brokenness in this stack move way achieves horrendous appearance of the construction. Structures with vertical challenges cause a startling jump in seismic quake powers at the level of brokenness. Structures that have less segments or dividers in a particular story or with unusually tall story will by and large damage in that story. Various designs with an open ground story made arrangements for halting collapsed or were genuinely hurt in Gujarat during the 2001 Bhuj quake. Structures with segments that hang or float on emanates at a moderate story and don't go the entire way to the foundation, have discontinuities in the pile move way.

OBJECTIVE AND SCOPE OF PRESENT WORK

The objective of the ongoing work is to focus on the Seismic Response of Multi-Story Structures with Floating Columns. This study is huge as Floating Column is certain part and keeping in mind that maybe not fittingly explored or arranged will provoke enormous disillusionment of plan. Appropriately G+7 Story building are focused on while Floating Column is given and when It isn't given to Float Column. From this audit, we can obviously learn about best sensible circumstance for Floating Column. Direct Seismic Analysis is finished to focus on the approach to acting and effect of Floating Column.

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II. LITERATURE REVIEW

Nanabala et.al (2014) did seismic investigation of a typical and drifting segment building. Examination of a (G+5) story typical structure and a (G+5) story drifting segment building was performed for outer sidelong powers. Examination was finished by utilizing SAP 2000. Additionally variety of the two designs by applying forces of the past seismic tremors i.e., applying ground movements to the two designs, from that dislodging time history values were looked at. This study was to find whether the construction is protected or dangerous with drifting segment when worked in seismically dynamic regions and furthermore to find drifting section building is prudent or not. It was reasoned that drifting section building has 40% more rebar steel and 42% more substantial amount than an ordinary structure. So the drifting section building is uneconomical to that of a typical structure. The last end was not to favor drifting segment structures. With expansion in components of all individuals likewise it was giving a greater number of removals than an ordinary structure and furthermore cost of development was more.

Sabari. S, Mr. Praveen J.V (2014), did the Seismic Analysis of Multi-Story Building With Floating Column where the FEM examination was done for 2D and 3D multi-story outlines with and without drifting sections concentrating on the reactions of the design with various seismic excitations where the RC outlines were of various firmness on floor wise and level of the structure, that were viewed as in the investigation keeping PGA and time term factors as constants having different recurrence and featuring with elective measures including solidness equilibrium to lessen the anomaly in the first and story above which is presented by the drifting sections. The time history investigation was finished by thinking about the entire arrangement of edges of the structure to Bhuj seismic tremor excitations, and gave to analyze the outcomes got from the examination of a wide range of casings utilizing the SAP2000 programming. The paper subsequently closed as results acquired utilizing

present limited component code for the static and free vibration were approved and the unique investigation of casing was concentrated on by shifting section size aspect and reasoned that by expanding the segment size the most extreme removal and bury story float values can be diminished.

PrernaNautiyal et.al (2014), did Seismic Response Evaluation of RC Frame Building With Floating Column Considering Different Soil Conditions. The impact of the drifting segment under quake excitation for various soil conditions and a straight unique examination was completed for the 2D casing of the multi-story working with and without drifting section to accomplish the reaction of the edge for more secure and practical plan of the construction under such soil conditions. G+3 and G+5 second opposing edges were dissected. The outcomes were checked the reaction range examination for changing soil conditions and base shear and minutes for both G+3 and G+5 models including the outside and inside segments and bars. It was seen that the base shear for medium soil are higher than the hard soil in both the cases base shear from medium to hard soil condition diminishes, and facilitate it tends to be presumed that, as the level of the structure expands the variety of most extreme minutes gets decreased for various soil conditions. Consequently from the consequences of the reaction range examination acquired for both the second obstruction outlines shows that the area of drifting segments at corners as of demonstrated in the cases considered are more basic than others position.

A.P. Mundada and S.G. Sawdatkar (2014), did Comparative Seismic Analysis of Multi-Story Building with And Without Floating Column. This study managed the compositional drawing and outlining drawing of the structure having drifting segments. Existing G+7 private structure was dissected utilizing identical static investigation of burden appropriation on drifting segments and different impacts because of it utilizing STAAD Pro V8i. The fundamental goal was to track down the different insightful properties of the construction and furthermore figure out the efficient and conservative plan of the design. The review was completed on a current G+7 private structure with and without drifting sections where the models of the structure incorporated every one of the parts that impacted mass, strength, firmness and deformability of the construction. Various boundaries, for example, pivotal burden, second circulation, significance of line of activity of power and seismic variables were read up for the models. The starter study was done on the structure looking at three model situations where the principal objective of the review was to work on the seismic execution of the structure with drifting sections and to work on a legitimate plan of the structure with drifting segments.

Rajesh Harugoppa (2014), concentrated on the Effect of Floating Columns on Seismic Forces of Rc Supporting Flexural Members in A normal OMRF With and Without Infill Masonary. It for the most part pointed toward making mindfulness in the development of seismic tremor safe plan of multistory structures by qualifying the weakness as far as the requests of shear power and twisting second in chosen individuals from a run of the mill building. The models were chosen for the examination of the designs to satisfy the necessities, for example, to build the floor space record and furthermore staying away from firmly separated segments in the ground story to get huge continuous space which is expected for the development of individuals or vehicles. A (G+4) working with normal second opposing casing in two symmetrical bearings were upheld on cantilever projections of the shafts in first floors and move braces presented

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for supporting drifting segments, were chosen and dissected utilizing the STAAD Pro programming. The direct strategy for examination was utilized to dissect the models and show the outcomes, and the outcomes were investigated from seismic loads of floors, base shear and vertical dissemination. The outcomes got, while a structure was intended for gravity loads and a tremor to such an extent that the drifting segments upheld on cantilever projections, shear force in cantilever ranges are high nearly and have a high propensity to bomb under shear which is unexpected and fragile. Likewise, the drifting segments upheld on move braces shows shear force, length hanging second, support hoarding second were fundamentally high with expansion in range of move supports and furthermore that demonstrating with swaggers for the infill dividers gives more impact in shear force.

PratyushMalaviya, Saurav (2014), completed Comparative Study of Effect of Floating Columns on the Cost Analysis of a Structure Designed on Staad Pro V8i. The design was examined utilizing the product STAAD Pro, where the drifting segments are given and the limited component definition was thought of. Different kinds of designs considered had drifting sections in the construction at various positions and were contrasted and the construction with no drifting segments. The utilization of steel and cement in each sort of demonstrated structure were thought about and presumed that the outlined design with no drifting segments was more affordable in view of least nodal relocations with uniform dispersion of stresses at all pillars and sections.

III. METHODOLOGY

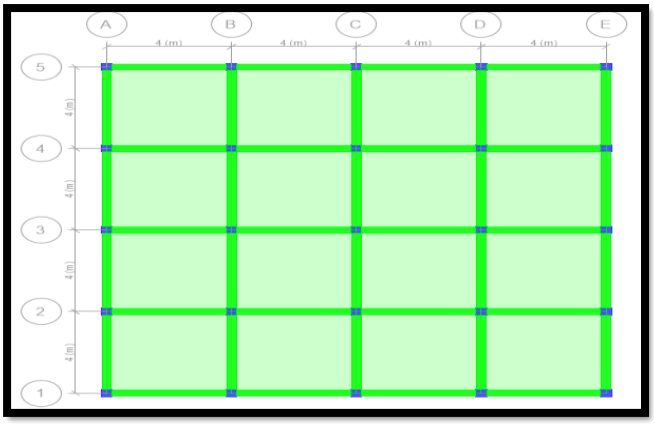

Figure 1:- Typical Plan of Building for Case III

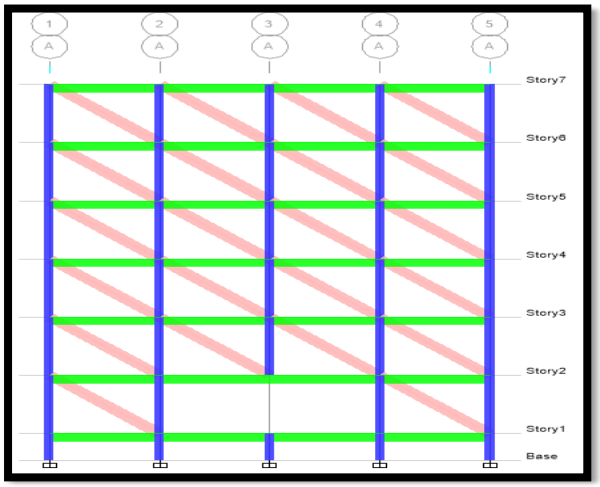

Figure 2:- ***Elevation of Building for*** (WithoutShear Wall)

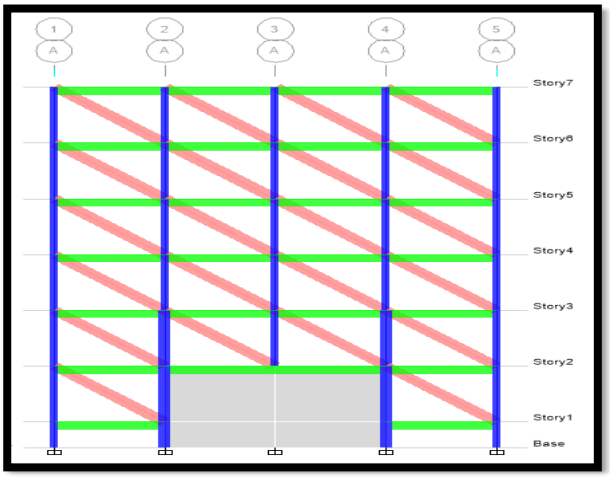

Figure 3:- ***Elevation of Building for Case III*** Case III (With Shear Wall)

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In order to carry out analysis of structures data required is enlisted below in tabular form:

Table 1:- Detail Description of Building Configuration

Sr. No	Structural Element	Dimension
1	Material Used	Concrete M-30 Reinforcement Fe-500
2	Number of Storey	7
3	Plan Dimensions	Case I - 16 X 16 m Case II - 7 X 7 m Case III - 16 X 16 m
4	Type of Structure	RCC
5	Damping	5%
6	Density of Concrete	Concrete 25kN/m3 Brick masonry 20kN/m3
7	Poisson Ratio	Concrete 0.2 Brick masonry 0.15
9	Spacing in X-Direction	4 m
10	Spacing in Y-Direction	4 m
11	Number of Bays in X-Direction	4
12	Number of Bays in Y-Direction	4
13	Typical Storey Height	3.2 m
14	Bottom Storey Height	1.5 m
15	Total Height of Structure	20.7 m
16	Case I Beam Column Column (Supporting column to float)	 0.300 X 0.450 m 0.300 X 0.300 m 0.425 X 0.425 m
17	Case II Beam Column (External)	 0.300 X 0.600 m 0.300 X 0.300 m
	Column (Internal)	0.500 X 0.500 m
18	Case III Beam Column Column (Supporting column to float)	 0.300 X 0.450 m 0.300 X 0.300 m 0.425 X 0.425 m
19	Thickness of Slab	0.200 m
20	Thickness of Masonry Wall	0.150 m
21	Thickness of Shear wall	0.150 m
22	Modulus of Elasticity	Concrete 25000 N/mm2 Brick Masonry 1255 N/mm2
23	Support Conditions	Fixed

Table 2:- Detail Description Loads Applied on Structure

Sr. No	Type of Load	Intensity
1	Dead Load Self-Weight of Slab Self- Weight of Beam Self- Weight of Column Floor Finish	 1 kN/m2
2	Live Load	4 kN/m2
`3	Wall Load	(Height – depth of beam) x (density of masonary) x (thickness of wall) E.g. (3.2-0.45) x (20) x (0.150) = 8.25 kN/m (Respectively calculate for other cases)

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Table 3:- Detailed Specifications for Seismic Analysis (Acc To IS 1893-2002)

DETAILED SPECIFICATIONS FOR SEISMIC ANALYSIS (ACC TO IS 1893-2002)		
1	Zone	IV
2	Zone Factor (Z)	0.24
3	Importance Factor (I)	1
4	Response Reduction Factor (R)	5
5	Soil Type	II
6	Method of Analysis	Seismic Coefficient Method Response Spectrum Method

IV. VALIDATION OF SOFTWARE RESULTS

To make it evidence that, the work carried out for the present study using computer aided software 'ETABS' is valid; a problem stated in book of 'Earthquake Resistant Design of Structure' by 'Agrawal and Shrikhande' (pg. no. 287) is considered and its results are compared with results obtained by software.

Validation Problem for Lateral Displacement

In this section the, the results are obtained for lateral displacement for the two-storey RC moment resisting open ground storey frame (referring pg. no. 287 of Agrawal and Shrikhande text book) by the software ETABS.

For this, 1000kN force is applied at each slab level successively and displacements of stories are calculated by making successive joints as fixed supports as shown in Figure 4.10.

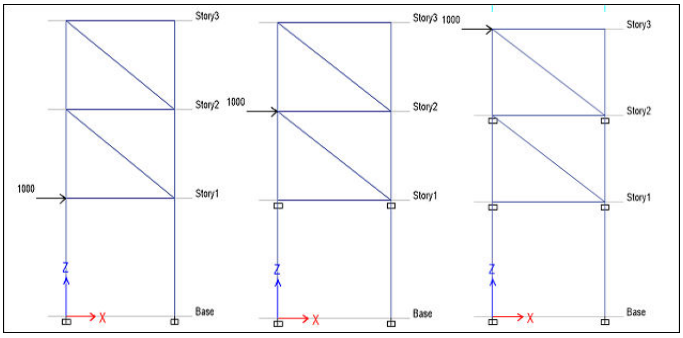

Figure 4:-Displacements of Stories by Making Successive Joints as Fixed Supports

Table 4:- Validation of results for Displacement of each storey by 'ETABS' and 'Text Book of Agarwal and Shrikhande'

Sr. No.	Force on successive storey	Displacement	
		ETABS (m)	Book values (m)
1	1000 kN	0.07226	0.0710
2	1000 kN	0.00320	0.0031
3	1000 kN	0.00283	0.0028

IV. RESULTS

Table 5: Comparison of Vertical Deformation, Bending Moment, Shear Force, Support reaction, Base-Shear, Table 5:- Stay Moment and Stay Shear.

Type		Without considering infill effect		With considering infill effect	
		Without Stay	With Stay	Without Stay	With Stay
Beam Below the	Vertical deformation	7.9	5.1	1.5	1.2
	Bending Moment	207.282	103.842	21.56	11.792
	Shear force	148.5696	95.427	21.841	17.159

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Floating Column	Support Reaction	1981.457	2359.294	1904.529	2515.219
	Base Shear	660.059	763.751	1695.147	1688.077
	Stay Moment	-	92.743	-	12.632
	Stay Shear	-	47.649	-	9.487

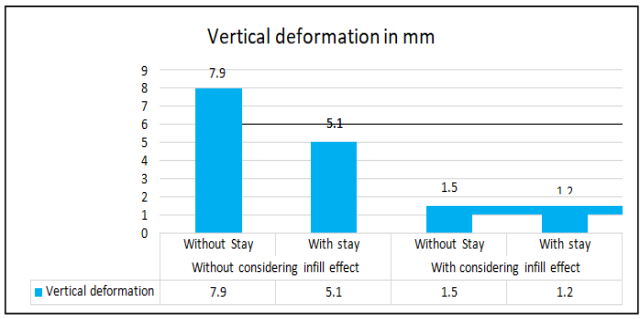

Figure 5:-Comparison of Vertical Deformation.

OBSERVATION

- There is sudden drop is observed in vertical deformation by providing the stay below the floating column.
- The vertical deformation is reducing by 36% and 20% in case of with and without infill effects.
- Sudden drop of 81% in vertical deformation is observed from above graph after comparing space frame without infill effect and with infill effect in case of without stay.
- Similarly, in case of with stay drop of 76% in vertical deformation is observed from above graph after comparing space frame without infill effect and with infill effect.

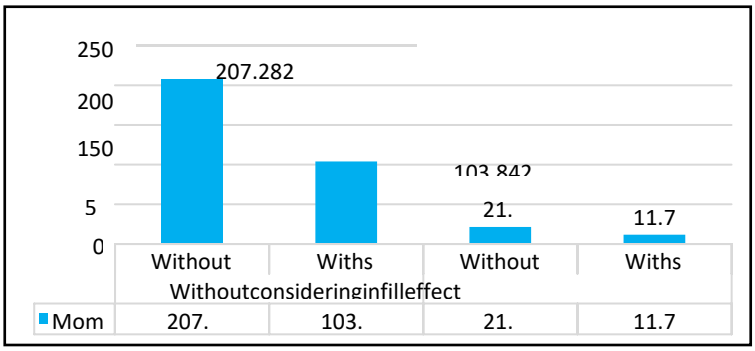

Figure 6:-Comparison of Bending Moments when Floating Column is resting on Beam which is Supported by Column.

OBSERVATION:

- From above graph, it is observed that there is drastic fall in Bending moment by considering frame without infill effect and with infill effect.
- Fall of 50% in value of bending moment is observed after comparing frame with and without stay in case of frame without infill effect.
- Similarly, after comparing frame with and without infill effect for with and without stay case drop of approximately 88% in value of bending moment is commonly observed.

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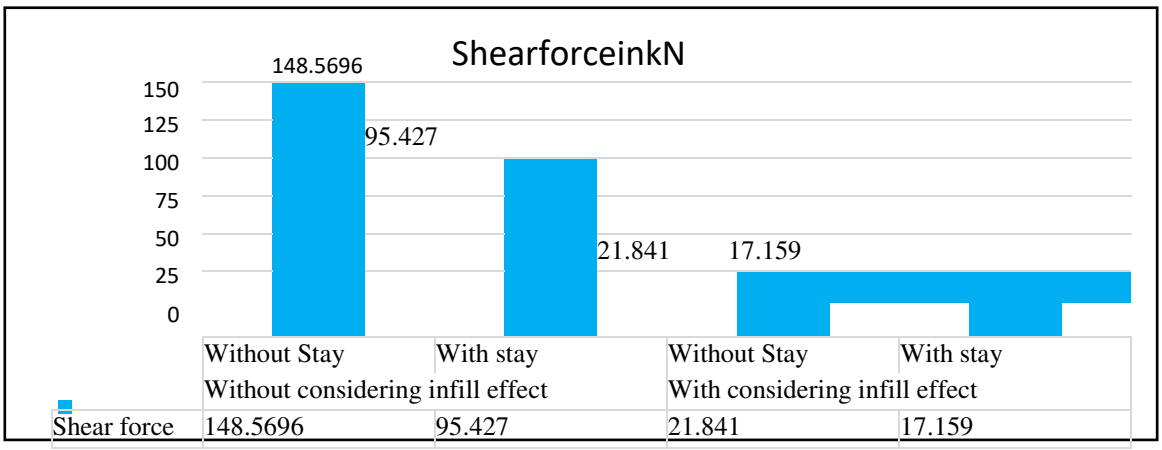

Figure 7:-Comparison of Shear Force when Floating Column is resting on Beam which is Supported by Column.

OBSERVATION:

1. Similar pattern of drop is observed in Shear force value of around 83% of frame with and without infill effect in case of with and without stay after observing drop pattern of Bending moment.

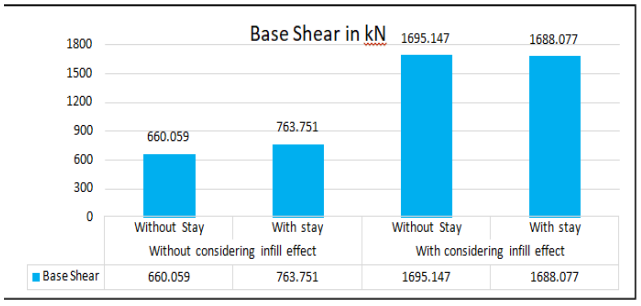

Figure 8:- Comparison of Base-Shear when Floating Column is resting on Beam which is Supported by Column.

OBSERVATION:

- There is increase in value of base shear after providing infill effect in the both with and without stay cases.
- The base shear value is increased by 61% and 55% in case of without stay and with stay by considering infill effect.

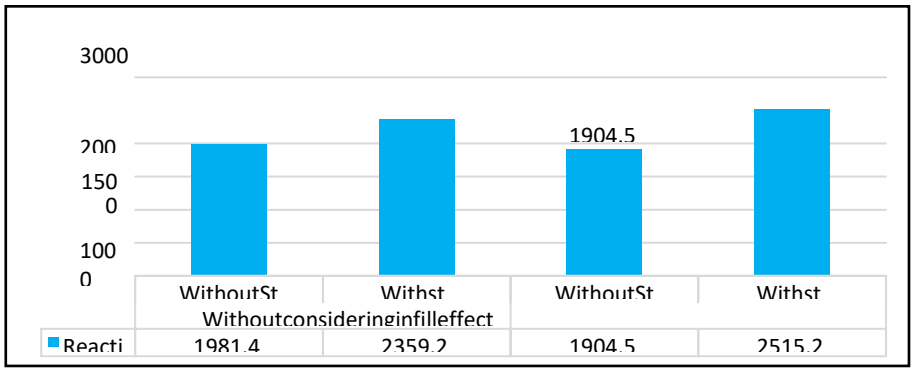

Figure 9:-Comparison of Support Reaction

OBSERVATION:

From above graph, it is observed that there is increase in value of support reaction by providing stay in both infill effect and without infill effect.

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Table 6:- Results of Supported Column Which Supports Beam Having Floating Column.

Type		Without considering infill effect		With considering infill effect	
		Without Stay	With Stay	Without Stay	With Stay
Supported Column	Bending Moment	85.445	22.888	42.061	28.915
	Shear Force	49.907	15.72	26.419	19.086
	Axial Force	1779.887	1802.06	1781.554	1430.258

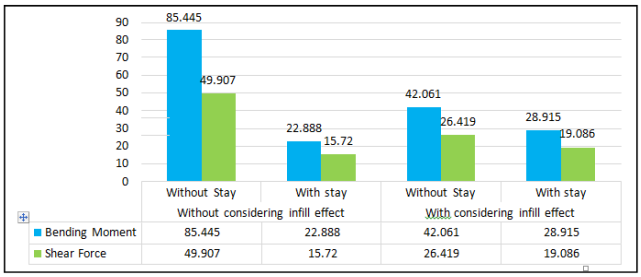

Figure 10:- Comparison of Bending Moment and Shear Force of Supported Column.

OBSERVATION

- From above graph, it is observed that by providing stay there is decreasing value of shear force and bending moment in the support column.
- In case of without infill effect shear force and bending moment, values are decreased by 68% and 73% respectively. Similarly, in case of infill effect they are decreased by 32% and 28% respectively.

Table 7:- Results of Base Beam

Type		Without considering infill effect		With considering infill effect	
		Without Stay	With Stay	Without Stay	With Stay
Base Beam	Bending Moment	64.667	108.375	67.827	67.748
	Shear Force	71.798	80.331	68.973	65.115

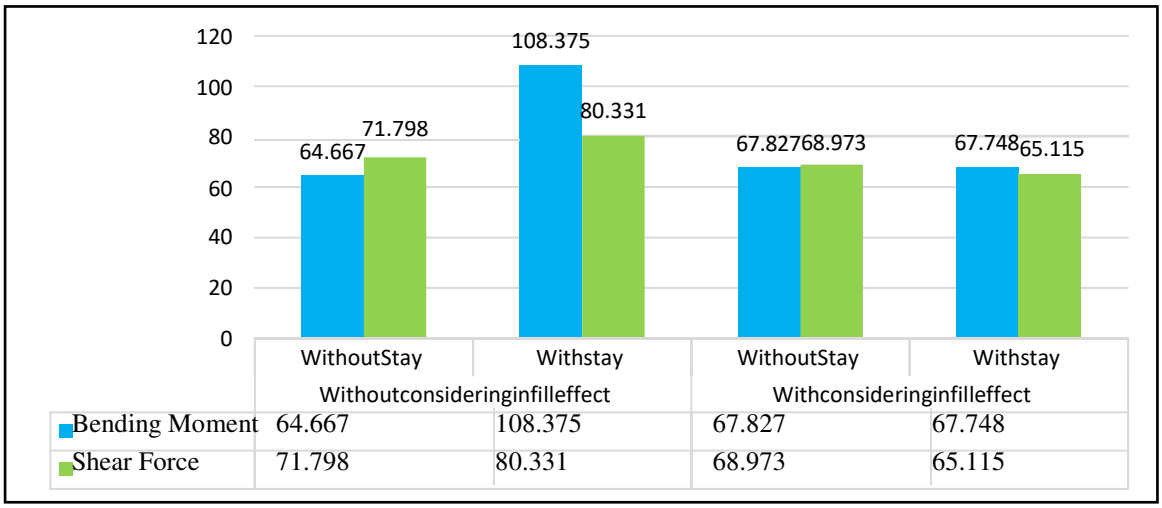

Figure 11:- Comparison of Bending Moment and Shear Force of Base Beam.

OBSERVATION

1. From above graph, it is observed that higher moments and shear force is developed in base beam by providing stay in space frame without infill effect.

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V. CONCLUSION

1) Provision of brick infill in floating column structures makes it less vulnerable to earthquake as infill increases the stiffness of the structure and also increases the base shear carrying capacity of the structure.
2) Response spectrum method predicts lesser base-shear and lesser member forces as compared to seismic coefficient method.
3) In case, when shear wall is provided in periphery, axial forces in floating column tremendously increases for both static as well as dynamic analysis.
4) Almost more than 50% reduction in axial forces for supported column after provision of stay is observed for both static as well as dynamic analysis.
5) Providing stay below floating column is the best structural configuration as Bending moment and Shear force values drastically reduces.

From the above analysis, it is concluded that increase in the sizes of beams and columns can affect the results of floating column. Change in structural configuration can gives better results for floating column.

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