JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Seismic Analysis of Multi Story Reinforced Concrete Buildings with Floating Column

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Abstract : Quakes in various areas of the planet exhibited the unsafe results and weakness of deficient designs. In present situation structures with drifting segment is a normal component in the advanced multistory development in metropolitan India. The drifting segment is an upward component which at its lower level lays on a bar. The seismic latency powers produced at its floor levels in a structure should be brought down along the level to the ground and any deviation or intermittence in this heap move way brings about lackluster showing. Along these lines elements, for example, drifting sections are profoundly unwanted in structures worked in seismically dynamic region. Present review looks at the unfavorable impact of the drifting segments in building. Models of the casing are created for multi-story RC structures with and without drifting segments to complete near investigation of underlying boundaries like normal period, base shear, and even removal under seismic excitation. Results acquired portrays that the elective proportion of giving sidelong propping to diminish the parallel deformity, ought to be taken. The RC working with drifting section in the wake of giving horizontal propping is broke down. A relative investigation of the outcomes got is completed for all over three models. The structure with drifting segments subsequent to giving bracings showed moved along seismic execution

IndexTerms **- Floating Column, Seismic Response, Bracings**

I. INTRODUCTION

India is an emerging nation, where urbanization is at the quicker rate in the nation including embracing the techniques and kind of developing structures which is under immense advancement in the beyond couple of many years. As a piece of urbanization multi-story structures with compositional intricacies are developed and have open first story as an undeniable component. This is basically being embraced to oblige stopping or gathering entryways in the primary story as displayed in fig.1.1.

The way of behaving of a structure during quakes relies basically upon its general shape, size and calculation, notwithstanding the way that the seismic tremor powers are conveyed to the ground. Though the absolute seismic base shear as experienced by a structure during a quake is subject to its normal period, the seismic power dispersion is reliant upon the appropriation of firmness and mass along the level and these powers are required to have been brought down along the level to the ground by the most brief way; any deviation or brokenness in this heap move way brings about terrible showing of the structure. Structures with vertical difficulties cause an unexpected leap in seismic tremor powers at the degree of brokenness. Structures that have less sections or dividers in a specific story or with abnormally tall story will generally harm in that story. Numerous structures with an open ground story planned for stopping imploded or were seriously harmed in Gujarat during the 2001 Bhuj tremor. Structures with sections that hang or float on radiates at a moderate story and don't go the whole way to the establishment, have discontinuities in the heap move way.

OBJECTIVE AND SCOPE OF PRESENT WORK

The goal of the current work is to concentrate on the Seismic Response of Multi-Story Structures with Floating Columns. This study is significant as Floating Column is undeniable component and while perhaps not appropriately investigated or planned will prompt gigantic disappointment of design. Accordingly G+7 Story building are concentrated on while Floating Column is given and when It isn't given to Float Column. From this review, we can plainly find out about best reasonable situation for Floating Column. Direct Seismic Analysis is completed to concentrate on the way of behaving and impact of Floating Column.

II. LITERATURE REVIEW

Meghana (2016) Analyzed structure overall by Linear static examination for RC comprising drifting segments in various situations in plan, for structures of different level, for example, (G+3), (G+10) and (G+15) in tremor zones V. Correlation of different boundaries, for example, story shear, story float and story relocation is finished. It was presumed that the drifting section gave at edges of external face of building is more basic since it shows greater uprooting and float values in both composite and RCC

structures. Story shear worth will be something else for lower floors, than the higher floors because of decrease in weight when we go from base to highest levels. The base shear esteem diminished because of presentation of drifting section for example decrease in mass of segment in RCC Structure.

Sarita et.al (2015) concentrated on the Effect of Floating Columns for Seismic Response of Multi-Storied RC Framed Buildings. Static and dynamic examination utilizing reaction range technique was finished multistoried structure with and without drifting sections. Various instances of building were concentrated by fluctuating area of drifting segments floor wise and inside the floor. Underlying reaction of building models concerning Fundamental time span, Spectral speed increase, Base shear, Story float and Story relocations was researched. Investigation was done by utilizing STAAD Pro V8i programming. It was presumed that in working with drifting segments there is an expansion in essential time span in both X-bearing as well as Z-course when contrasted with working without drifting sections. By presentation of drifting sections in a structure base shear and ghastly speed increase diminishes. Along these lines, it enjoys specialized and utilitarian upper hand over ordinary development. The Story removals increment while drifting sections are presented in the structure.

Isha et.al (2015) concentrated on the Seismic Response of Multi-Storied Irregular Building with Floating Column. Basic place of drifting segment in upward unpredictable RC structures of (G+5) and (G+7) for zone II and zone V was assessed. Additionally impact of size of bars and sections conveying heap of drifting segment was evaluated. Reaction of building, for example, story float, story uprooting and story shear was assessed by utilizing ETABS programming. It was presumed that Story relocation and story float builds because of presence of drifting section. Story uprooting increments with expansion in load on drifting segment. Story shear diminishes in presence of drifting segment due to decrease of mass of section in structure. Expansion in size of pillars and sections work on the presentation of working with drifting segment by decreasing the upsides of story uprooting and story float. Expanding aspects of pillars and segments of just a single floor doesn't diminishes story uprooting and story float in upper floors. Along these lines, aspects ought to be expanded in two back to back floors for better execution of building.

Shama et.al (2015) assessed Seismic Behavior of Floating Columns. The work intended to explore impact of a drifting section under seismic tremor excitation for different soil conditions and as there is no arrangement or amplification factor indicated in I.S. Code. Thus assurance of such factors for protected and conservative plan of a structure having drifting segment was finished. Consequently, an endeavor was taken to concentrate on conduct of working during seismic action. In this review, seismic way of behaving of RC multistory structures with and without drifting segment was thought of. Examination was done for multi-story structures of (G+3) arranged in zone IV, Using ETABS Software. Straight Dynamic Analysis was finished two layered multi story outline with and without drifting section to accomplish above point for example reactions (impact) and factors for protected and efficient plan of the construction under various tremor excitation. It was reasoned that there is expansion in dislodging for drifting segment structures contrasted and standard structure. The bury story float additionally increments with expansion in number of stories. Story float is something else for drifting segment structures in light of the fact that the sections are taken out consequently mass gets expanded subsequently the float. As the mass and firmness increments base shear additionally increments. Subsequently, base shear is something else for drifting section structures contrasted with regular structures.

Ashwin (2015) did examination of (G+1) story working with and without Floating Columns. Greatest bowing snapshot of the designs was assessed. Cost of the construction was principally reliant upon most extreme minutes that were found out. Structures were intended for the greatest bowing second. Two-layered outline investigation was finished utilizing SAP 2000. Near examination gives the most extreme twisting second that follow up on structures with and without drifting segment, from which efficient structure can be accomplished. SAP2000 was utilized with the end goal of investigation of two-layered outline examination. It was reasoned that as the twisting second is greatest if there should arise an occurrence of construction with drifting section the design required more material so ordinary segment structure is more prudent. The areas expected by structure with drifting section are more. Drifting section is exposed to most extreme shear force when contrasted with structure with ordinary segment. The pressure design is more basic if there should be an occurrence of drifting segment than in structure with ordinary section.

III. METHODOLOGY

In the present study, the multistoried RC moment resisting space framed buildings having floatingcolumn with and without infill as well as when provided with and without Stay are modeled and analyzed using professional software ETABS 2013 in compliance with the codes IS 456:2000 andIS 1893(Part 1): 2002.

Parametric investigation is carried out mainly to study the behavior of Floating Column in presenceand absence of infill effect and to check the best possible accommodation of Floating Column withminimum deformations. Parameters such as Base-Shear, Storey Shear, Storey Displacement and Member forces of Buildings when Stay is provided below the floating column is studied and resultsare obtained so that failures of Floating Column will be avoided and the risk in designer's mind will vanish. Various cases that are taken for study are given in tabular form representing the investigation work.

Table No 4.1: Description of Models with different Structural Systems.

Case No	Name of Structural System
I	Floating column resting on beam which is supported on column.
II	Floating column resting on cantilever beam with and without stay.
III	Providing RCC wall between columns which is supported by frame having floating column.

The configuration of these Systems differs from each other and therefore each model is representedin figure to get the clear idea of providing Stay to floating column. The aim of adopting these systems is to resist the lateral loads i.e. seismic load. This in recent trend has become an unavoidable venture therefore analyzing and designing floating column with some additional careswill give better results. All the analysis results are represented in tabular form and graphs are obtained based on analysis data for all cases, observations are made based on this data.

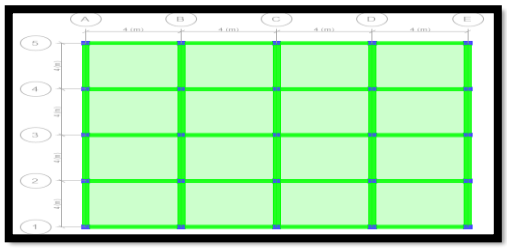


Figure 4.1: Typical Plan of Building for Case I

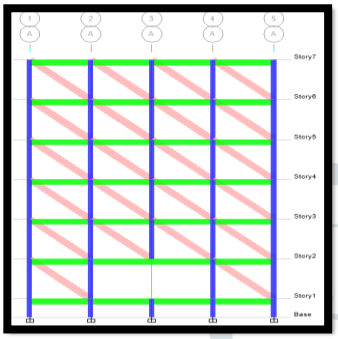


Figure 4.2: Elevation of Building for Case I Stay

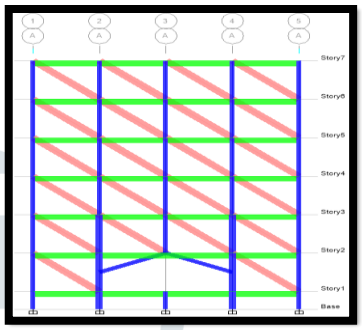


Figure 4.3: Elevation of Building for Case IWithout With Stay

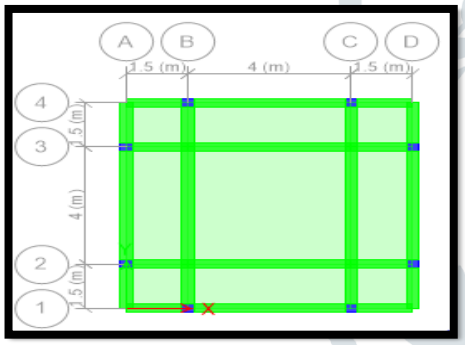


Figure 4.4: Typical Plan of Building for Case II

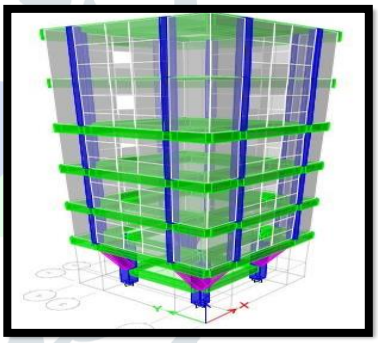


Figure 4.7: 3D View of Building With RCC wall

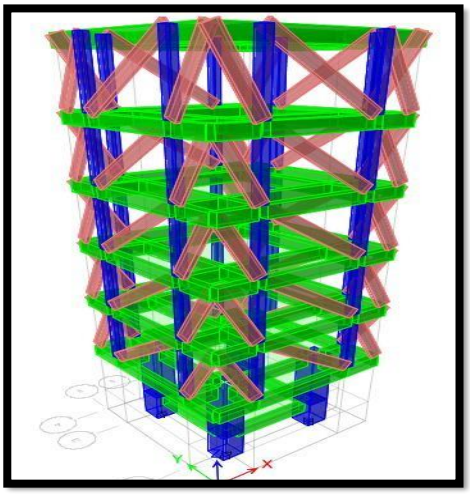


Figure 4.5: 3D View of Building for Case II Stay

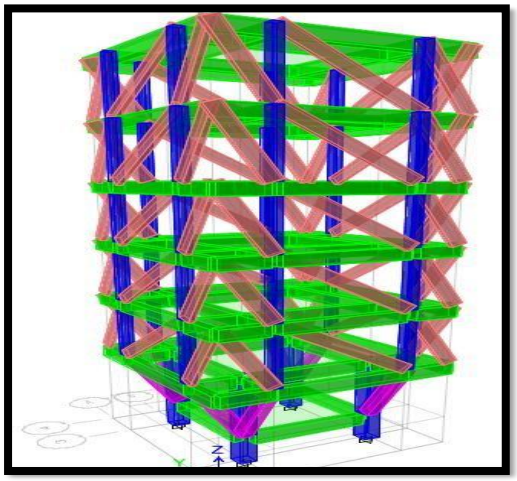


Figure 4.6: 3D View of Building for Case IIWithout With Stay

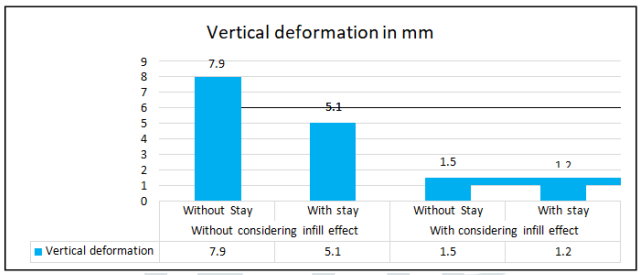
Detail Description of Building Configuration

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

IV. RESULT AND DISCUSSION

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

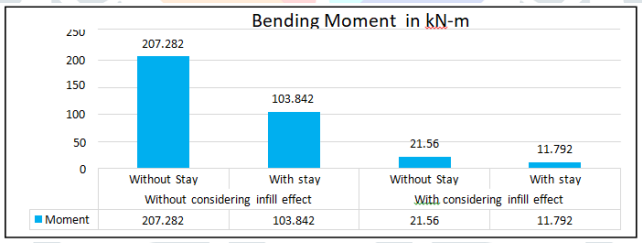
Type		Without considering infill effect		With considering infill effect	
		Without Stay	With Stay	Without Stay	With Stay
Beam Below the Floating Column	Vertical deformation	7.9	5.1	1.5	1.2
	Bending Moment	207.282	103.842	21.56	11.792
	Shear force	148.5696	95.427	21.841	17.159
	Support Reaction	1981.457	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



Comparison of Vertical Deformation.

OBSERVATION

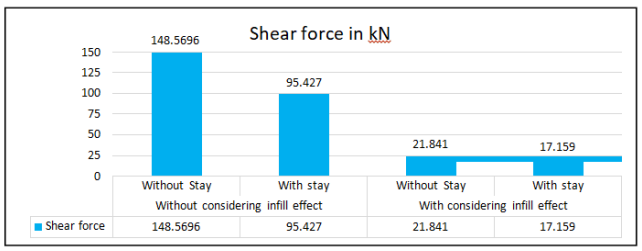
- There is sudden drop is observed in vertical deformation by providing the stay below the floating column.
- The vertical deformation is reducing by 36% and 20% in case of with and without infill effects.
- Sudden drop of 81% in vertical deformation is observed from above graph after comparing space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



Comparison of Bending Moments when Floating Column is resting on Beam which is Supported by Column.

OBSERVATION:

1. From above graph, it is observed that there is drastic fall in Bending moment by consideringframe without infill effect and with infill effect.
2. Fall of 50% in value of bending moment is observed after comparing frame with andwithout stay in case of frame without infill effect.



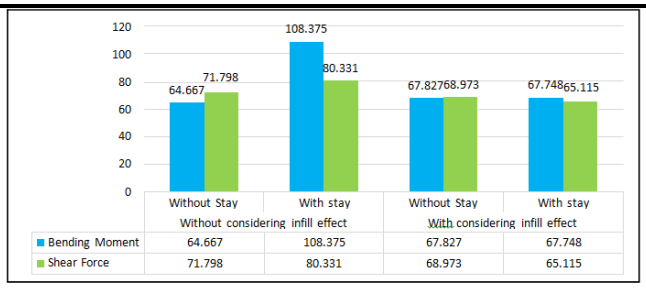
Comparison of Shear Force when Floating Column is resting on Beam which is Supported by Column.

OBSERVATION:

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

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



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

Comparison of Bending Moment and Shear Force of Base Beam.

V. CONCLUSION

- From both analysis method, it is noticed that the floating column building without any stay gives more displacements in vertical direction i.e. deformation.
- Provision of floating columns into the structural system makes the system flexible there by reducing the base shear for seismic static and seismic dynamic loads.
- 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.
- Response spectrum method predicts lesser base-shear and lesser member forces as compared to seismic coefficient method.
- In case, when shear wall is provided in periphery, axial forces in floating column tremendously increases for both static as well as dynamic analysis.

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