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Behavior of RCC structure with different configuration of infill wall with different configuration of RCC FRAME

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Abstract: Framed reinforced concrete structures are most commonly types of structures constructed all over the world due to ease of construction and rapid progress of work. Generally, brick or block work masonry is done in these frames which act as an infill panels in the framed structure. Infill walls provide the lateral stiffness to the structure. Its behaviour is very different from the bare frame structure.in this research we are trying to find the structural behaviour of Rcc structure when subjected to lateral loads and applying the bracing with changing the position of infill we observe that the position makes a huge difference in structural behaviour. nowadays typical structures with irregularities in it becomes a trend to change the infill with glass panel. our is to find the location of infill which is good for structure and its stability.

Methods adopt here by taking the different type of structure like T-shaped and inverted T-shaped structure and applied different positions of infill to check the effects on structure.

The results of this is compared with the bare frame and we observed that the bare frame shows maximum deflection, reduction in stiffness, story drift maximum.

Infill in the structure shows comparative stability in the structure.

As per our results we can suggest the stable positions of infill our aim is to provide the best possible positions of infill in irregular structure.

Keywords: multistore structure, role of infill, masonry infill, modelling parameters, story response evaluation.

I. Introduction

Behavior of masonry infilled concrete frames under the lateral load is studied. Investigations showed that, one of the most appropriate ways of analysing the masonry infilled concrete frames is to use the diagonally braced frame analogy. RCC buildings are generally analysed and designed as bare frame. But after the provision of infill walls, mass of the building increases and this will result in the increase of the stiffness of the structure. During the seismic activities, response of the structure with infill walls is quite different for the structure without infill walls. Infill walls changes the dynamic behaviour of the structure. In this study two G+8 storied structure models are generated. In one structure, brick infill walls are modelled as strut element. These struts act as a compression member. In the other structure, only bare frame structure is modelled and also different patterns of infill is modelled to study the infill effect. All the parameters i.e. beam sizes, column sizes, floor height; load parameters etc are same for both the structures.

RELATED WORK:

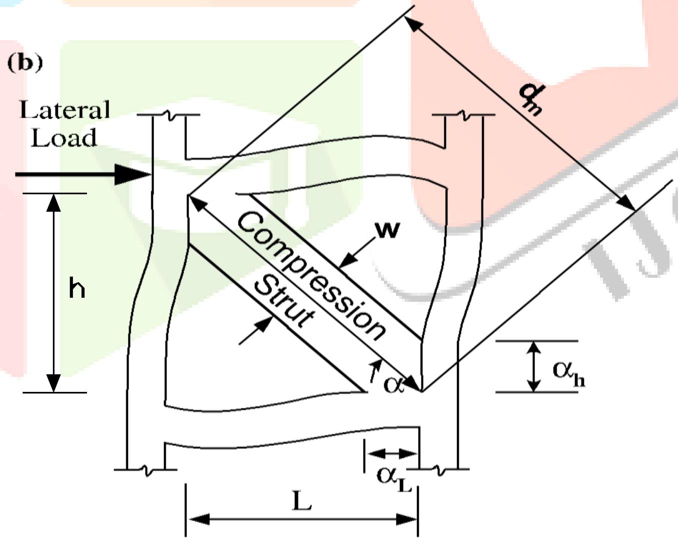
Paulay & Priestley proposed a theory about the seismic behavior of masonry infilled frame and a design method for infilled frames. Authors said that although masonry infill may increase the overall lateral load capacity, it can result in altering structural response and attracting forces to different or undesired part of structure with asymmetric arrangement. This means that masonry infill may cause structural deficiencies. Infilled frames behave differently with respect to lateral load level. At low levels, both concrete frame and infill act in a fully composite manner. Smith & Coull presented a design method for infilled frame based on diagonally braced frame criteria. The developed method considered three possible modes of failure of infill: shear along the masonry, diagonal cracking through masonry and crushing of a corner of infill. They assumed effective width of diagonal compression strut as equal to one tenth of the diagonal length of the infill panel. At the initial design stage, frame must be designed on the basis of the gravity loading. Smith & Carter examined multi-story infilled frames for the case of lateral loading. In the light of experimental results, authors proposed design graphs and design method based on an equivalent strut concept. First, they focused on the composite behavior of infilled frame and failure modes. Then, the factors that affect the effective width of diagonal compression strut were determined. Finally, with known factors and behavior, the design curves to estimate equivalent strut width, cracking and crushing strength of infill panel were presented.

Methodology:

In this study we are considering the effect of infill in previous research we observe that the infill act as masonry strut in respective direction of lateral loading the effect of strut depends on the strength of the masonry wall also the width of strut depends on the wall strength. previous researches shows that the grades of mortar also make considerable difference in the RC structure.

The strut width of masonry wall can be predicated through the formula given in IS 1893-2016.

The infill acts as a strut as it can be seen from its deformed shape when the buildings is subjected to lateral loads (as shown in figure below), and the properties of such a strut are calculated as per is 1893 2016

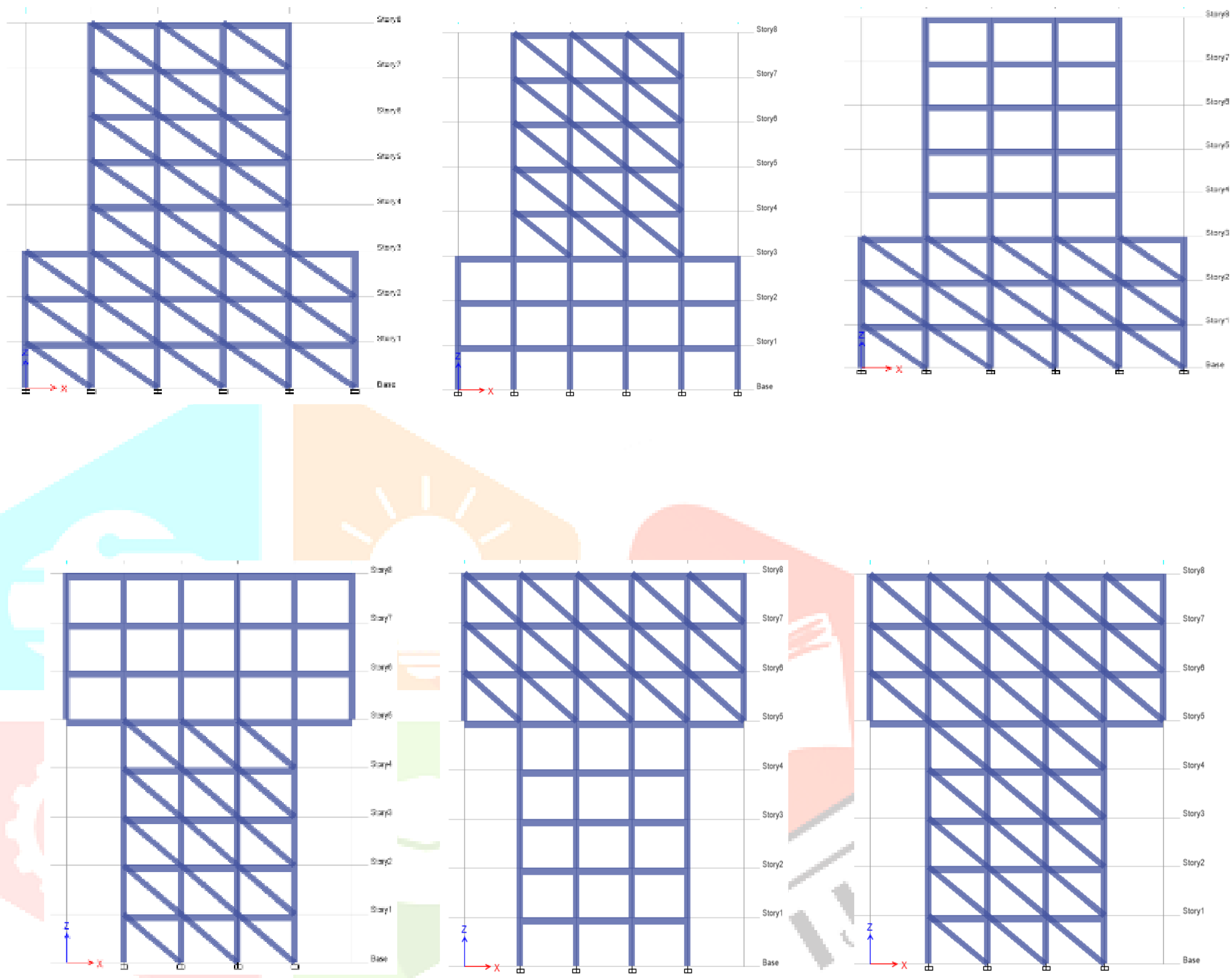


MODELLING AND ANALYSIS:

The analysis of G+8 storied RCC structure is carried out using ETABS software for special moment resisting frame situated in zone 4. These RCC G+8 storied structures are analyzed for infill panels and without infill, different configuration of infill and different patterns of structure to study the infill effect.

Story displacement, story drift, drift is check in this study.

DIFFERENT MODELS DESIGN IN ETABS WITH DIFFERENT CONFIGURATION OF INFILL:



FIG(A):DIFFERENT CONFIGURATION OF INFILL WITH DIFFERENT CONFIGUARED STRUCTURE

RESULTS AND DISCUSSIONS:

DRIFT, DISPLACEMENT FROM THE SOFTWARE ETABS.

Story response of T-shape structure with different infill patterns:

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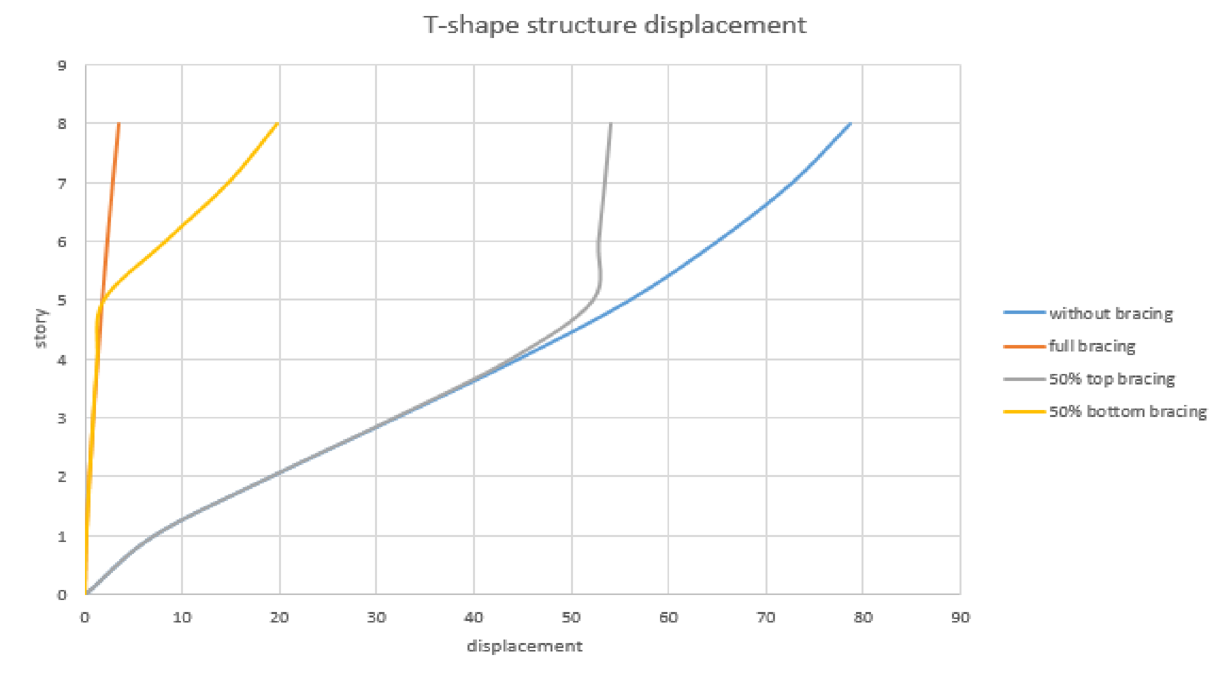
DRIFT, DISPLACEMENT FROM THE SOFTWARE ETABS.

Story response of T-shape structure with different infill patterns:

Story response discussed for T-shape:

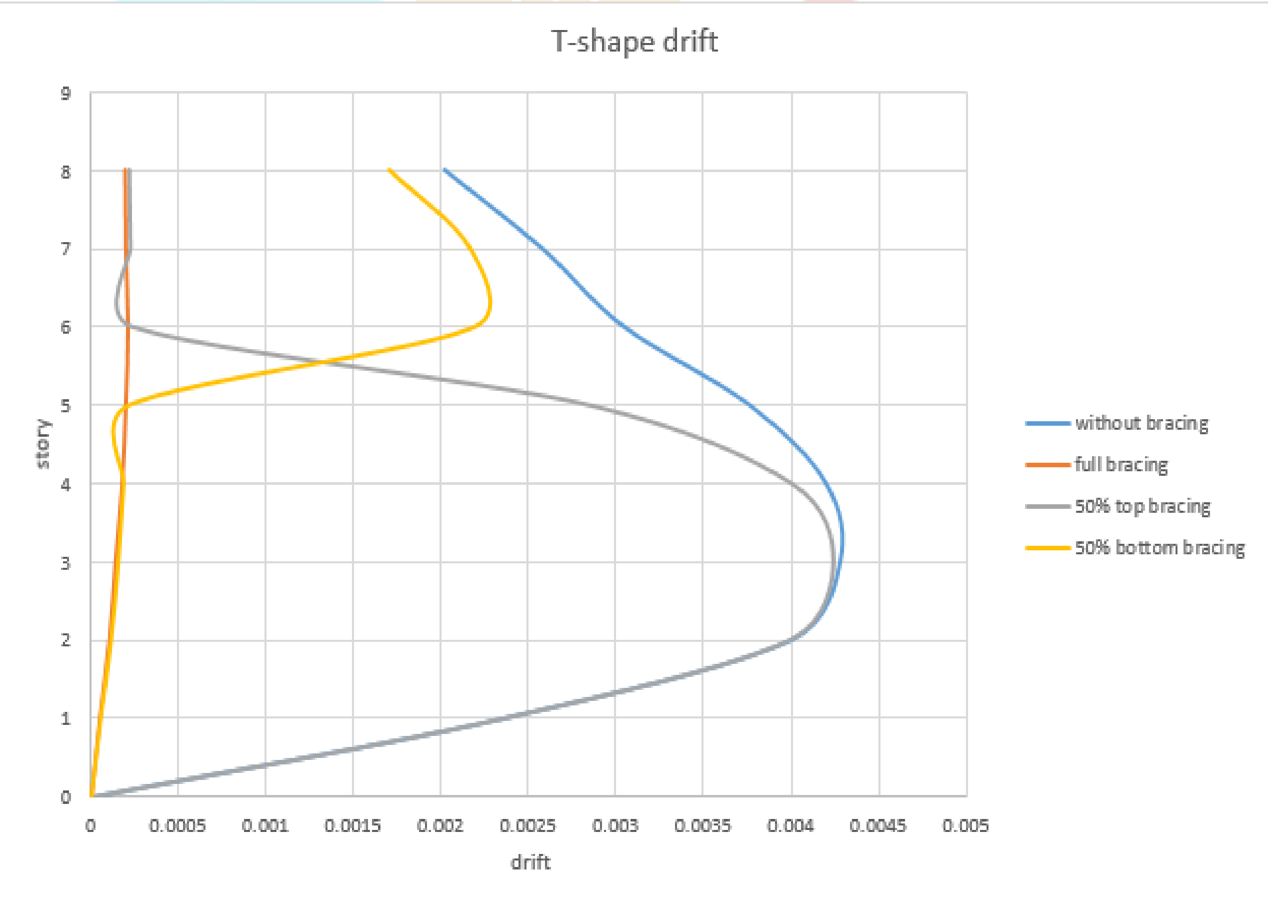
Story displacement of full bracing T-shape structure, without bracing ,50%top bracing,50%bottom bracing:

T-shape structure displacement					
Story	**Elevation**	**full**	**top bracing**	**bottom bracing**	**without bracing**
	m	displacement	Displacement	displacement	displacement
0	0	0	0	0	0
1	3	0.154	7.038	0.158	7.048
2	6	0.452	18.972	0.474	19.021
3	9	0.851	31.684	0.837	31.864
4	12	1.295	43.68	1.264	44.47
5	15	1.751	52.139	1.914	55.899
6	18	2.264	52.733	8.216	64.926
7	21	2.823	53.384	14.703	72.656
8	24	3.43	53.989	19.69	78.596



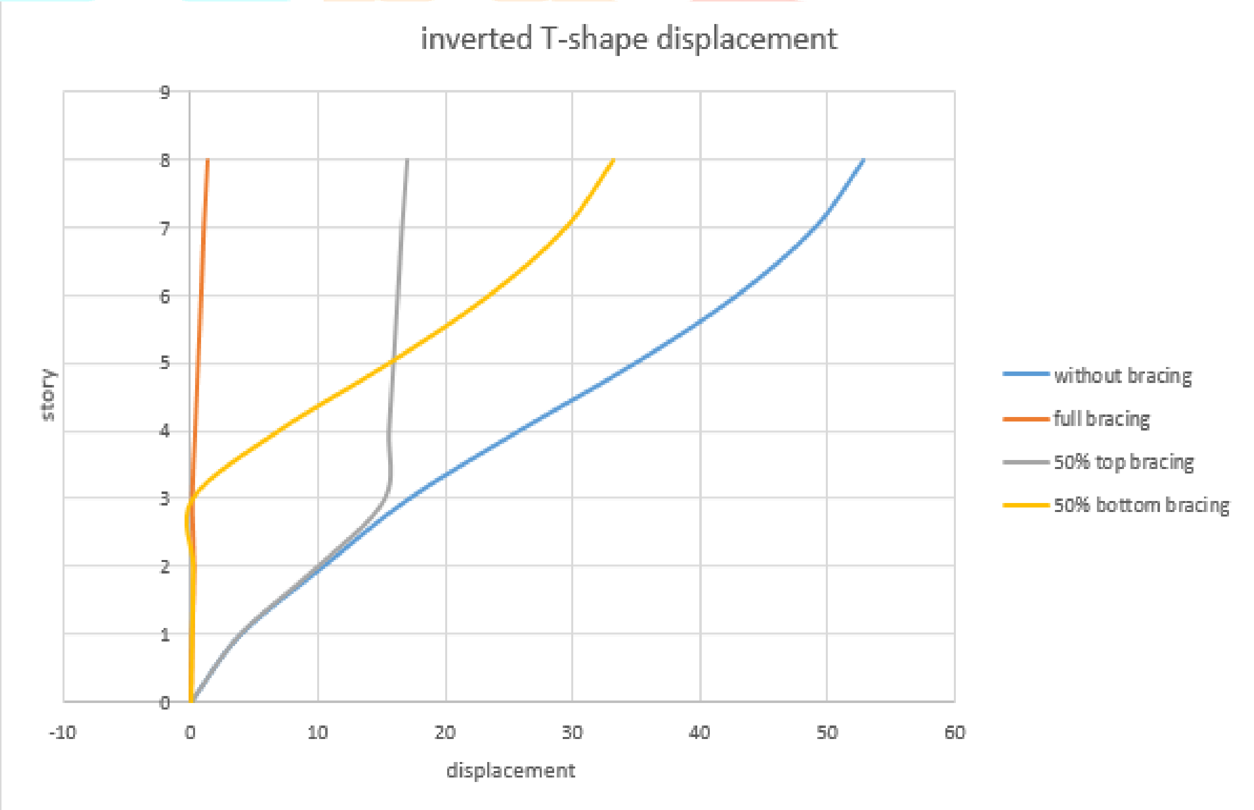
Story drift of full bracing structure,without bracing ,50%top bracing,50%bottom bracing:

T-shape structure displacement					
Story	**Elevation**	**full**	**top bracing**	**bottom bracing**	**without bracing**
	m	drift	Drift	drift	displacement
0	0	0	0	0	0
1	3	5.10E-05	0.002346	5.30E-05	0.002349
2	6	0.000107	0.003985	0.000111	0.003998
3	9	0.000143	0.004237	0.000153	0.004281
4	12	0.000184	0.003999	0.000184	0.004202
5	15	0.000206	0.00284	0.000216	0.003764
6	18	0.000219	0.000232	0.00219	0.003045
7	21	0.000206	0.000223	0.002162	0.002576
8	24	0.000202	0.000217	0.0017	0.002018



Story displacement of full bracing inverted T-shape structure,without bracing ,50%top bracing,50%bottom bracing:

inverted T-shape displacement					
Story	**Elevation**	**full**	**top bracing**	**bottom bracing**	**without bracing**
	m	displacement	Displacement	displacement	displacement
0	0	0	0	0	0
1	3	0.112	3.844	0.082	3.894
2	6	0.272	9.938	0.175	10.343
3	9	0.115	15.238	0.082	17.061
4	12	0.352	15.586	6.786	25.68
5	15	0.607	15.934	15.48	34.821
6	18	0.848	16.276	23.342	42.831
7	21	1.078	16.607	29.38	48.96
8	24	1.391	17.027	33.146	52.81



Story drift of full bracing inverted T-shape structure, without bracing ,50%top bracing,50%bottom bracing:

inverted T-shape drift					
Story	**Elevation**	**full**	**top bracing**	**bottom bracing**	**without bracing**
	M	drift	Drift	drift	displacement
0	0	0	0	0	0
1	3	3.70E-05	0.001281	2.70E-05	0.001283
2	6	5.40E-05	0.002035	3.20E-05	0.001298
3	9	5.30E-05	0.001766	5.70E-05	0.002043
4	12	7.90E-05	0.000151	0.00226	0.002157
5	15	9.50E-05	0.000137	0.002898	0.002263
6	18	0.000109	0.000148	0.002621	0.00267
7	21	0.000124	0.000159	0.002013	0.002883
8	24	0.000113	0.000146	0.001255	0.003047

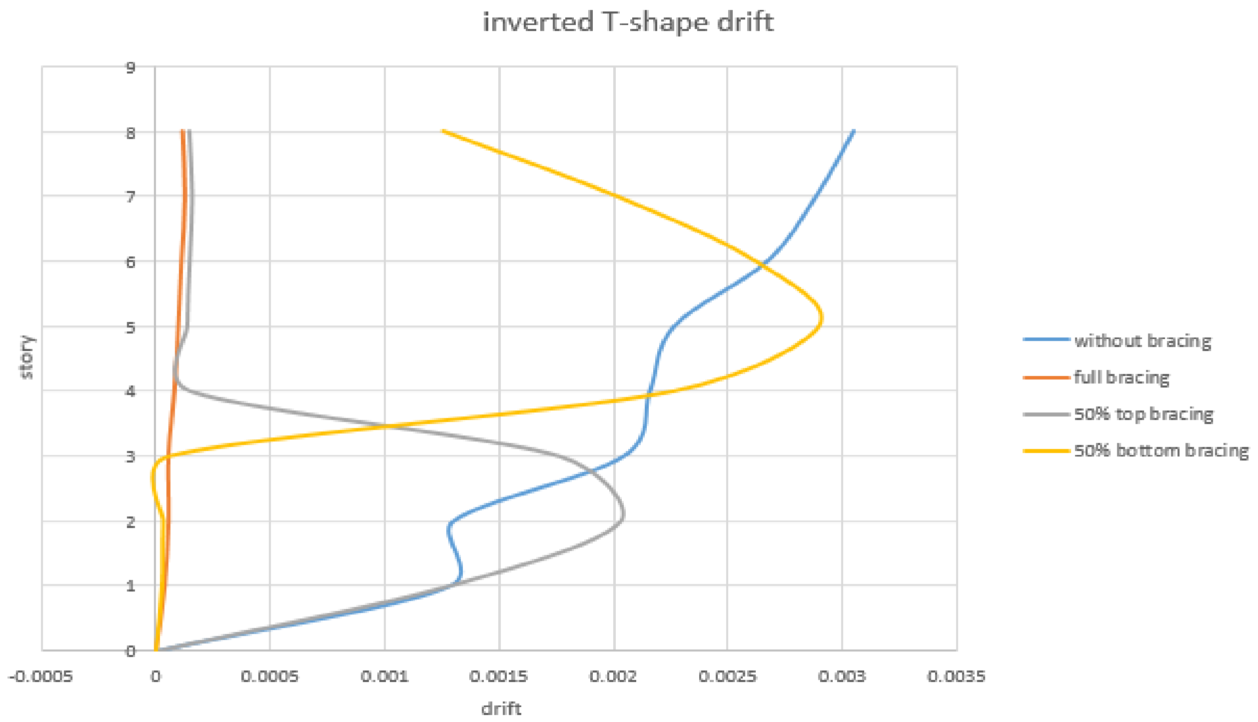


Table:01

Sr No	Configuration	Story drift		Max Disp	Max Storey shear storey level
a					
	Irregular frame (Inverted T shape frame)				
	Bare frame	0.00304	Story5	52.81	365.9
	Fully infilled	0.000124	Story7	1.391	365.9
	Partial infill with bottom 50% storey	0.002898	Story5	33.146	365.9
b	Partial infill with Top 50% storey	0.002035	Story2	17.027	365.9
	Irregular frame (T shape frame)				
	Bare frame	0.00428	Story3	78.59	125
	Fully infilled	0.000219	Story6	3.43	125
	Partial infill with bottom 50% storey	0.00219	Story 6	19.69	125
	Partial infill with Top 50% storey	0.004237	Story3	53.98	125

Conclusion

1. The effect of infill walls in the Building top story displacement, and drift is checked infill plays a major role in reduction of story drift and displacement.
2. Base shear is decreased due to the non-structural masonry infill walls, seismic behavior of R.C.C. Framed building changed.
3. From the results, we have to concluded that there is a reduction in the drift, displacement.
4. Due to masonry infills are considered to interact with their surrounding frames, the lateral stiffness and lateral load carrying capacity of structure increases.
5. Effect of infill in the structure of different configurations and patterns of infill shows good results of masonry arrangements.
6. In this study we have check that effect of infill pattern in the structure like bay frame shows more deflections and drift ,bay frame with full infill shows considerable reduction in behaviour of structure ,partially infilled wall shows response less than bay frame with full infill and more reduction observe compare to without infill, only bottom story infill bottom half portion shows stability in bottom and more deflection other than infill portion ,only top story infill top half portion this pattern shows maximum deflection at bottom which is not good for structure it's better to avoid absence of infill in bottom portion.
7. Similarly, we have to studied the different configurations of building like T-SHAPED, inverted T-shaped with different configurations all shows the presence of infill is making huge difference in the stability of structure
8. Due to infill walls in the Building top story displacement, and drift is reduced. Base shear is increased. The presence of non-structural masonry infill walls can modify the seismic behaviour of R.C.C. Framed building to large extent.
9. From the results, it can be clearly seen that there is a reduction in the drift, displacement.

10. When masonry infills are considered to interact with their surrounding frames, the lateral stiffness and lateral load carrying capacity of structure largely increase. Therefore, the inclusion of the effect of infill walls in the structural analysis of the buildings reduces the lateral load deflection and drift.

SCOPE FOR FURTHER STUDY:

Reinforced concrete (RC) frame buildings with unreinforced masonry (URM) infill walls are commonly built throughout the world, including in seismically active regions. URM infill walls are widely used as partitions throughout India, and despite often being considered as non-structural elements, they affect both the structural and non-structural performance of RC buildings.

For the further study, to obtain the real responses of the structures, the following recommendations are made:

- assess the R/C frames with infilled walls with different geometry of frame
- assess the R/C frames with infilled with effect of infill to column beam joint junction
- further study should be done to observe the shear failure of column due to force applied through infill strut.

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