COMPARATIVE STUDY OF ANALYSIS ON MASONRY INFILL WALLS

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ABSTRACT

It is common misconception that masonry infill in structural steel or reinforced concrete frames can only increase the overall lateral load capacity, and therefore must always be beneficial to seismic performance. If the masonry infill is ignored in the design phase, it may be assumed that each frame in each direction is subjected to very similar seismic lateral forces, because of the structural symmetry. The true influence of the infill on frames will be to stiffen these frames relative to the other frames .The consequence will be that the natural period of the structure will decrease, and seismic forces will correspondingly increase. Further the proportion of the total seismic shear transmitted by the infilled frames will increase because of the increased stiffness of these frames relative to the other frames. The high shear forces generated in the infilled frames are transmitted primarily by shear stresses in the panels.

The aim of this research work is to present a comparatively study and seismic analysis of multi storey 3D-RC frame building with infill and without infill for seven storey building using STAAD-PRO. The modal analysis of structure is carried out to know whether stiffness and mass of structure is correct or not.

Keywords -- *Masonry Infill Frame, STADD-Pro, Model Analysis, Displacement At Various Node*

I INTRODUCTION

Masoney infills works as compressive strut, infills have more significant in lateral loads such as seismic and wind forces as compared to vertical loads. The masonry walls used for partition purpose in buildings will contribute to initial lateral stiffness significantly. In severe earthquake loading the walls will get cracked and contribution to lateral stiffness is negligible. Masonry walls can be modeled as diagonal strut model or continuum plate model. The foregoing considerations will often mitigate against the use of isolated panels, and the subsequent discussion will be limited to interacting structural infill, where the role of the infill in influencing stiffness and strength is fully considered in the design process. In this work, STADD Pro software has been used in order to analyze and design RCC frame structure (G+6)

II STATEMENT OF PROBLEM

A (24×24)m , G+6 building with regular structure for a commercial complex is considered for study . modeling, analysis and design of structure is done on STADD Pro software. The building will be used for exhibitions as a show room, so that there are no inside walls in the building. Only external wall 230 mm thick with 12 mm plaster on both sides are considered.

Table 1 Preliminary Data

length×width	(24×24)m
No. of storey	7
Beam (at all floors)	(300×600)mm
Ground Beam	(300×600) mm
Column(at all typical floor)	(500×500)mm
Column (below ground level)	(950×950)mm
Slab thickness	100mm
Support conditions	Fixed
Beam releases	Axial force

2.1 Loading considerations

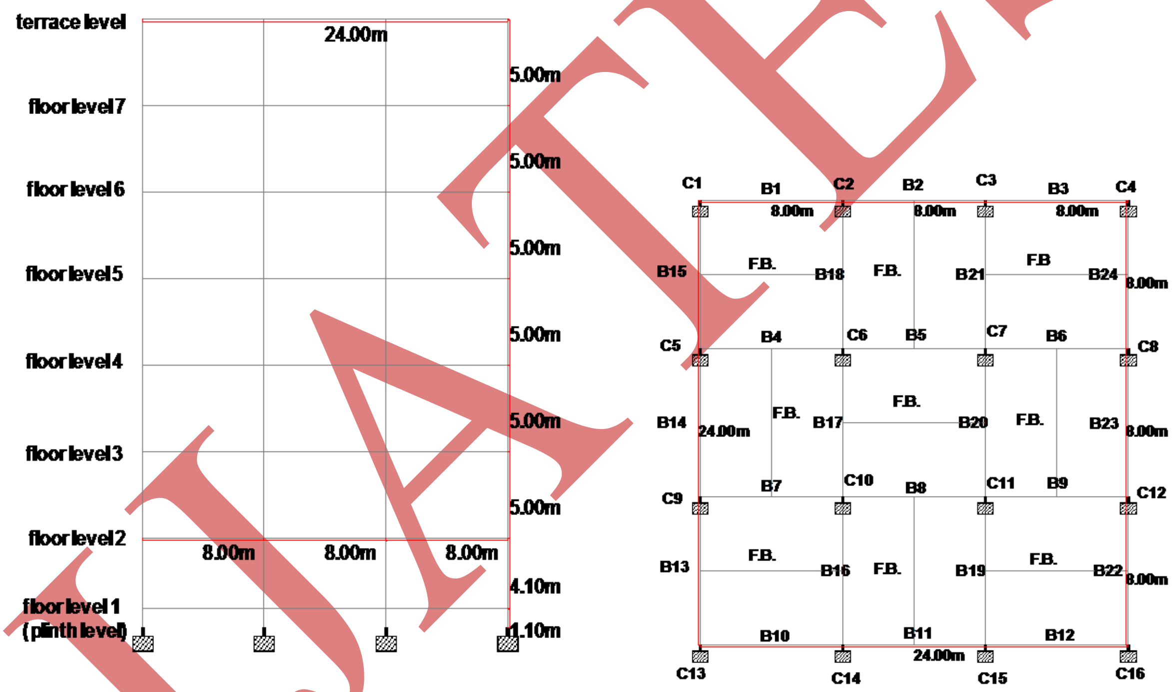


Fig. 1

Loads acting on the structure are dead load(DL), live load(IL) and earthquake load(EL).

DL: self weight of the structure, floor load and wall loads.

- Live load : 4.0 kN/m^2 at floor level, 1.0 kN/m^2 on terrace level
- Floor finish : 1.0 kN/m^2
- Water proofing : 2.0 kN/m^2
- Floor finishes : 1.0kN/m^2
- Seismic zones : IV
- Location : Gorakhpur city
- Soil type :Hard soil

- Response reduction factor :5
- Importance factor :1.5
- Damping : 5%
- Time period : 0.6466 (calculated as per IS 1893:2002)
- Wind load : As per IS: 875 (not considered wind load for design because of Earthquake loads exceed the wind loads , it exceed once a time Over 500 years.)
- Earthquake load : As per IS -1893-2002

2.2 Load Combinations

The analysis has been carried out for Dead load (DL) , Live load or imposed laod (IL) and earthquake load (EL) in both the direction i.e. sway to left (+ EL) and sway to right (-EL) by a Stadd- Pro.

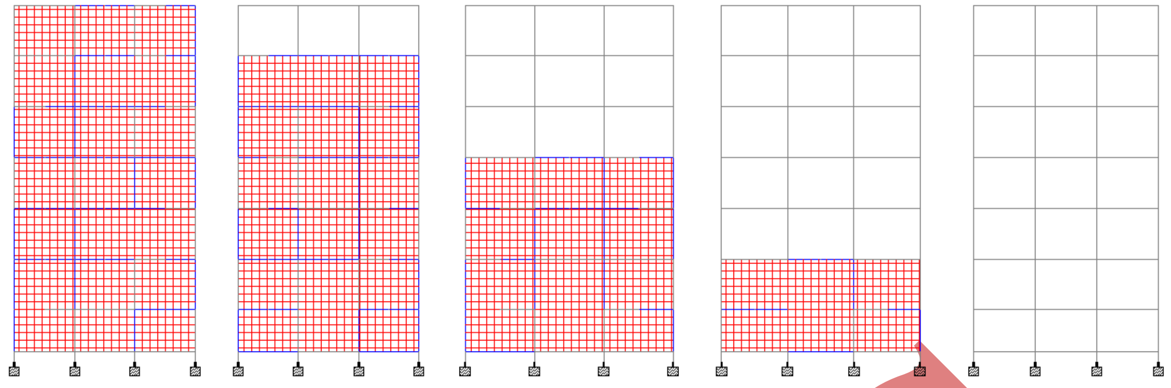
The combination of the above cases has been made according to Clause 6.3 of IS 1893(Part 1): 2002. the maximum moments and forces for the beams and columns for all the laod combinations for each member are considered for the design.

The different laod combinations are:

1. 1.5(DL+IL)
2. 1.2(DL+IL+ELx)
3. 1.2(DL+IL-ELx)
4. 1.2(DL+IL+ELz)
5. 1.2(DL+IL-ELz)
6. 1.5(DL+ELx)
7. 1.5(DL-ELx)
8. 1.5(DL +ELz)
9. 1.5(DL – Elz)
10. 0.9 DL+1.5 EL
11. 0.9 DL–1.5 EL

III. BUILDING CONFIGURATION OF 7 STOREY BUILDINGS FOR ANALYSIS WITH DIFFERENT % OF MASONRY INFILL WALLS

In this work, Five models were used to differentiate the effect of infill walls and location of infill on building analysis and effect of infill walls on lateral resistance and capacity of building is studied and compared with bare frame.



With 100% infill With 70% infill With 50% infill With 30% infill With 0% infill

Fig. 2

IV. COMPARATIVE RESULTS

4.1 Modal Analysis of 3D Frame

The modal analysis of structure is carried out to know whether stiffness and mass of structure is correct or not. The mass of structure is calculated from dead load and 50% of live load. As the structure is symmetrical, the mass of each member is lumped at respective ends. Since the structure is unsymmetrical in mass and stiffness the fundamental modse is torsion mode with time period.

Table 2 Result of modal analysis

% of infill	Mode No.	TimePeriod (Sec)	Modal mass participation(%)		
			X	Y	Z
With 100%	1	0.32444	63.37	0.00	18.08
	2	0.32410	18.09	0.00	63.41
	3	0.18073	0.00	0.00	0.00
With 70%	1	0.50881	8.94	0.00	19.24
	2	0.50866	19.26	0.00	8.91
	3	0.42372	0.00	0.00	0.00
With 50%	1	1.26501	0.00	0.00	35.54
	2	1.26142	35.59	0.00	0.00
	3	1.09912	0.00	0.00	0.00
With 30%	1	2.05730	0.00	0.00	54.41
	2	2.05005	54.45	0.00	0.00
	3	1.79430	0.00	0.00	0.00
With 0%	1	2.72276	0.00	0.00	71.71
	2	2.71148	71.72	0.00	0.00
	3	2.38509	0.00	0.00	0.00

4.2 Relative displacement of storey for following infills at different node

Table 3 (In X direction)

Infill /Node	1	2	3	4	5	6	7	8	9
With 100%	0	5.516	12.031	16.572	20.721	24.514	27.951	31.053	34.06
With 70%	0	5.511	12.022	16.573	20.739	24.588	28.103	32.72	87.98
With 50%	0	5.485	11.995	16.69	20.907	29.015	226.498	401.984	495.853
With 30%	0	5.508	11.762	23.308	368.791	731.287	1011.547	1198.691	1296.317
With 0%	0	14.503	322.853	848.693	1317.61	1696.431	1981	2170.995	2271.36

Table 4 (In Y direction)

Infill /Node	1	2	3	4	5	6	7	8	9
With 100%	0	2.592	7.744	10.067	11.102	11.59	11.784	11.848	11.94
With 70%	0	2.603	7.79	10.151	11.251	11.867	12.306	12.976	13.215
With 50%	0	2.681	8.114	10.791	12.536	15.193	17.422	18.478	18.784
With 30%	0	2.929	9.457	15.79	22.181	26.369	28.717	29.762	30.055
With 0%	0	2.057	12.319	21.939	28.628	32.883	35.261	36.323	36.621

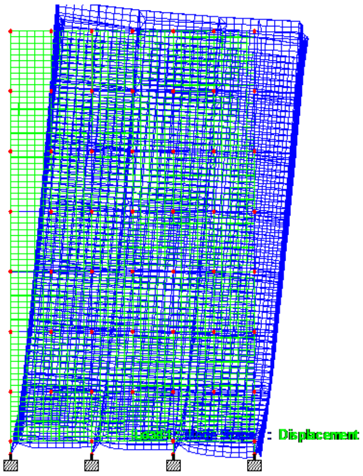
Table 5 (In Z direction)

Infill /Node	1	2	3	4	5	6	7	8	9
With 100%	0	5.518	11.955	16.531	20.688	24.482	27.92	31.026	34.01
With 70%	0	5.512	11.945	16.53	20.704	24.554	28.098	32.532	88.086
With 50%	0	5.483	11.911	16.637	20.947	28.494	227.027	404.052	498.866
With 30%	0	5.485	11.801	22.388	369.891	735.615	1018.404	1207.188	1305.673
With 0%	0	14.497	324.746	855.112	1328.336	1710.586	1997.616	2189.112	2290.176

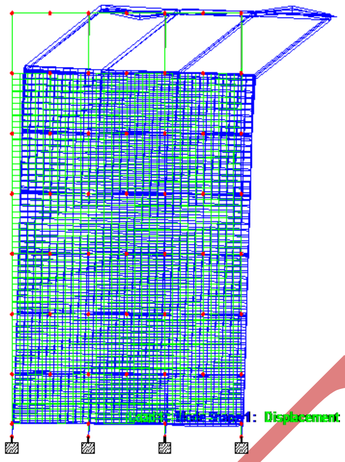
Table 6 (Resultant)

Infill /Node	1	2	3	4	5	6	7	8	9
With 100%	0	8.221	18.644	25.48	31.314	36.533	41.226	45.467	49.591
With 70%	0	8.217	18.652	25.514	31.39	36.718	41.601	47.93	125.197
With 50%	0	8.206	18.751	25.919	32.141	43.412	321.163	570.255	703.626
With 30%	0	8.307	19.158	35.969	522.798	1037.596	1435.688	1701.484	1840.142
With 0%	0	20.609	458.089	1204.98	1871.201	2409.37	2813.552	3083.302	3225.729

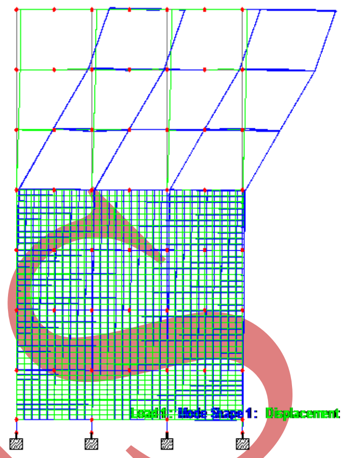
4.3 Displacement and Mode shape of comparative infills



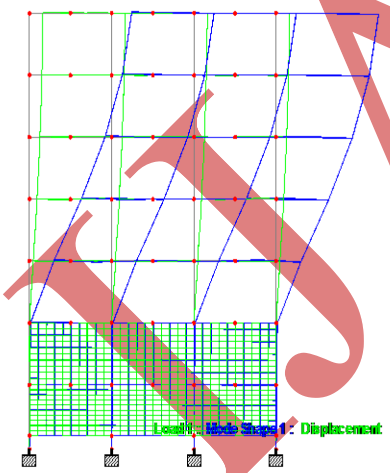
With 100% infill



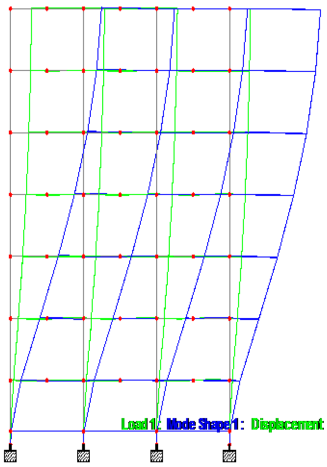
with 70% infill



with 50% infill



With 30% infill



with 0% infill

Fig. 3

4.4 Roof displacement (at node 9)

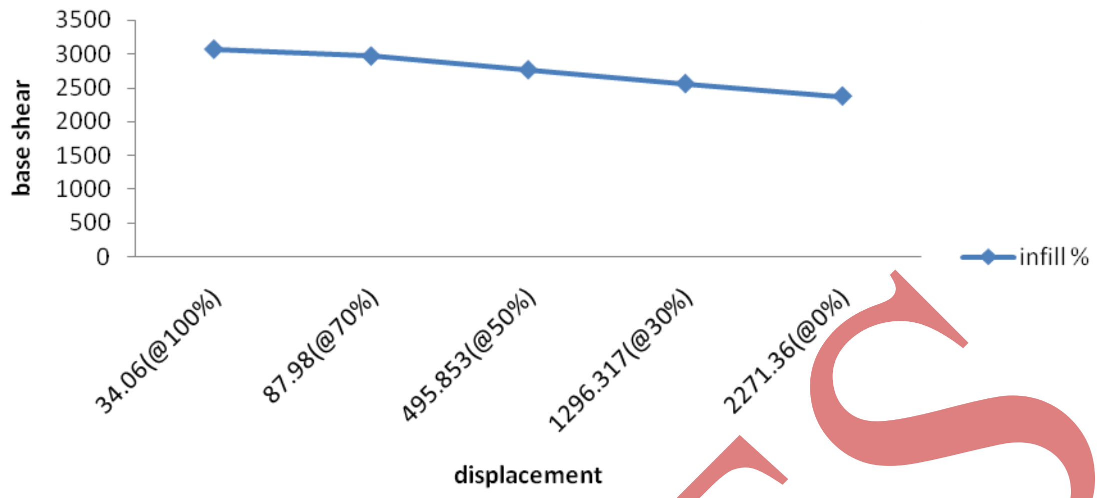


Fig. 4

V. CONCLUSION

From the results, we obtained that masonry infill affects the building displacement at various node due to lateral laods (sesismic) , we may conclude that with 100% infill gave lesser displacement as compared to 70%, 50%, 30% and 0% infills and 100 % infills provides more stiffness relative to other infills. The consequence will be that the natural period of the structure will decrease in 100% infill.

VI. REFERENCES

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