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Analysis of RC Building Frame with and Without Masonry Infill Walls

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Abstract: In countries like India where seismic activity is widespread, reinforced concrete frames with masonry infill walls are a popular technique. In structural analysis, brick walls are usually considered non-structural elements; only their mass fraction is considered and their structural properties such as strength and stiffness are usually ignored. Structures in seismically active areas are very susceptible to severe damage. In addition to bearing capacity, the structure must withstand lateral loads, which can cause significant stresses.

Reinforced concrete frames are the most used building materials in the world today. The frames of a framed structure are often filled with rigid materials such as brick or concrete block, usually to form an envelope.

In this research paper, we analyze the structure of a G+23-story rectangular 32mx24 base multi-story building with each floor height of 3.2m and various parameters such as slab thickness of 150mm, masonry infill support panel height of 390mm and width of 230mm, external column size 600 mm x 700 mm, internal column size 500 x 600 mm, beam size 500 x 700 mm, with IS code.

The four analyzed models, such as Model-I without infill wall structure, Model-II and Model-III are masonry infill walls due to the use of corresponding diagonal support panels such as eccentric rear and eccentric front type, while Model IV diagonal or X - type masonry infill the walls use support panel.

In this research, RCC frame structure with and without infill wall is analyzed using Etabs 2021 software and parameters such as seismic zone V, average soil condition, response reduction factor 5, significance factor 1.5 for major building etc. IS-1983. and run four models using the corresponding spectral method with Etabs 2021 software Sum all results in the layer displacement period.

Keywords: RCC Structure, Masonry infill, RCC frame, Seismic analysis, Seismic Zone, Soil Condition, Etabs Software.

I. INTRODUCTION

This file serves as a template, Masonry infill panels are being used in the construction of many Indian structures for both utilitarian and architectural purposes.

Masonry infill walls are often regarded as non-structural elements, and in practice—that is, when the building is intended for loading—their stiffness components are typically disregarded. But when lateral stresses are placed on the structure, infill walls often interact with the frame and also exhibit energy-dissipating qualities when subjected to seismic loads. When lateral loads are applied, masonry walls make the infill more rigid. A composite construction made up of infill walls and a moment-resisting planar frame is referred to as a "infill frame".

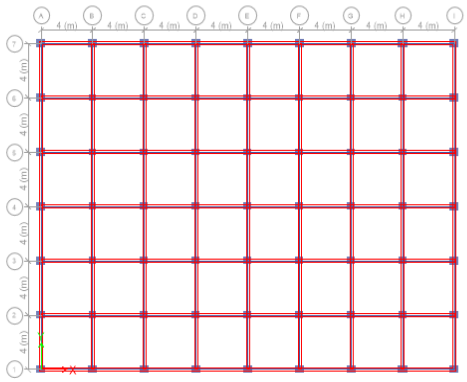
Masonry walls are used to create segregation and/or seclusion in the majority of reinforced concrete frame buildings. Since the infill wall is thought to be load-free in conventional practice, its involvement in the analysis and design of the structure is disregarded, and the infill's self-weight is taken into account when designing other structural components.

On the other hand, very high initial lateral stiffness and poor ductility were seen in frames with MI walls. The lateral load transmission mechanism of the structure shifts from a dominating frame action to a dominant lattice effect when the frames are filled with brick walls. This causes the bending moments and axial forces in the frame members to diminish.

A. Objective of Work

1) To investigate the structural analysis effects of G +23 layered structure with and without infill wall.
2) To investigate the effect of masonry infill on the stiffness of the structure.

B. Building Plan Configuration



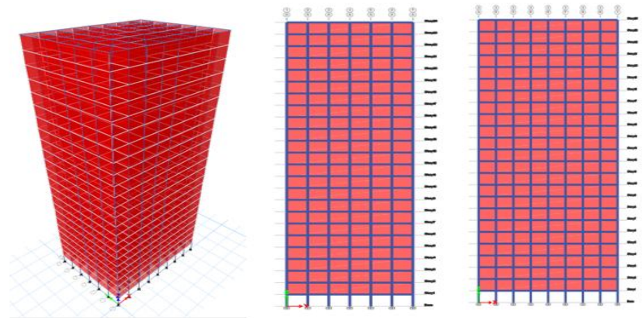


Fig. 1.1a 3D view MODEL-I Fig. 1.1b Without Infill Wall

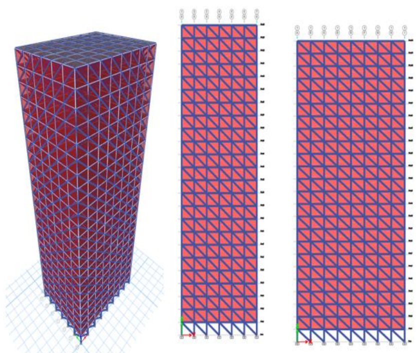


Fig. 1.2a 3D view MODEL-II Fig. 1.2b Masonry Infill Walls

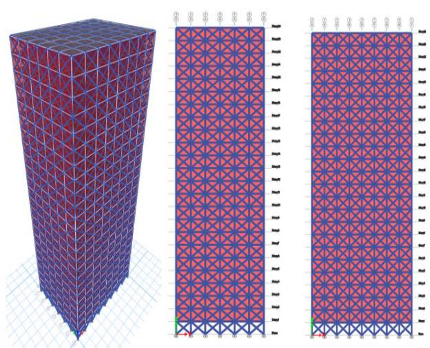


Fig. 1.4a 3D view MODEL-IV Fig. 1.4b Masonry Infill Walls

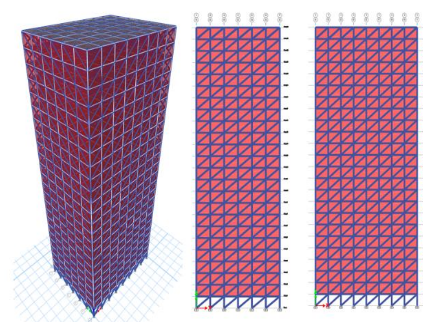


Fig. 1.3a 3D view MODEL-III Fig. 1.3b Masonry Infill Walls

II. LITRETURE REVIEW

3Mohs Nazim, M. Azeem, and Mohd Abdul Malik (2018): - They looked at three distinct building shapes: rectangular, L, and C, which have respective story counts of 11, 16, and 21 and are both regular and irregular in their plans. Nonlinear Static Analysis was used for all models, and the effect of changing the number of bays with an infill structure without soft storey condition was examined by comparing the bare frame with the infill frame. After completing the work related to hinge formation mechanism, base shear, storey drift, roof displacement, performance points, and time periods, they discovered that the inclusion of an infill wall increases the structure's capacity to support loads by eight to ten times compared to bare concrete.

Sneha Jangave and Kiran Tidke (2016): - The G+7 building's framed structure was examined, and the equivalent diagonal strut method was used to calculate the strut's width. The SAP2000 software was used to analyze the response spectrum method in Seismic Zone-II, and the effects of base shear, storey drift, and displacement were investigated for each model. They saw that RC frame structures with masonry infill, both with and without soft storeys, had higher base shares than bare frames. They also saw that the presence of infill walls greatly reduced the seismic behavior of frame structures and enhanced their strength and stiffness.

Dr. J. REX and S. N. Jaya (2019): - Using Etabs software and several seismic zones in India according to the IS Code, they investigated the G+10 Stories with infill walls. They also looked at storey float, storey share, twisting minutes, and building torsion between the frame with and without infill walls. They discovered that the storey shear analysis of infill walls has higher value for all seismic zone remaining case without infill wall in both X & Y direction, and similar to that, the bending moment has higher value for all zone remaining case without infill wall for both directions of X and Y. The lateral displacement in both directions, X & Y, without using the infill wall, had higher value than with infill walls in different seismic zones. According to

Vasinavi Battul, Mr. Rohit M. Shindhe, et al. (2017), they used SAP2000 software to analyze the seismic performance of an RCC structure. They looked at three and a quarter central openings, two distinct plans of rectangular 15 m x 30 m and square 15 m x 15 m shape of G+3 storeys located in an earthquake region, and pushover analysis was used. In addition to finding that the base shear of the infill structure significantly reduced in the bare frame in the plastic state, they also observed that the infill structure had more initial stiffness and less drift in the elastic state than the bare frame. Finally, they discovered that the infill structure is significantly more effective in low rise buildings compared to high rise buildings.

III.MATHODOLOGY

1) Open Etabs Software.
2) Creating Modelling of RC building
3) Applying property like beam, column, slab dimension and support on structure.
4) Applying Load like Dead load, Live load, seismic load and load combination as per IS code.
5) Getting Various Results
6) Results Analysis
7) Conclusion

IV.PROBLEM FORMULATION

These are RC buildings, both with and without brick infill walls. Configuration of Building Plans: Floor height: G+23, 24 by 32 meters, 3.2 meters There are six or eight bays total, with four meters separating each bay in each direction. Asset: The dimensions of the beams are 500 by 700 mm, while the outer and inner columns are 600 by 700 mm. The strut for the masonry infill walls is 390 by 230 mm in size, and the slab is 150 mm thick. Techniques of Seismic Analysis: Analysis of Response Spectrum Rectangular in design, there are four variants total—two with and without differently positioned infill walls. The kind of structure is the symmetric seismic parameter. RC structures and masonry infill walls are the same kind of construction. The building with the most storeys is G+23, which is shaped like a rectangle. Use the seismic zone-V, zone factor Z=0.36 and soil site factor 2 for mediums. soil conditions, Importance Factor I = 1.5 (per Table 6's Important Structure), Damping Ratio of 5% (per Table 3 Clause 6.4.2), and Response Reduction Factor (R=5) for the unique steel moment-resistant frame are displayed in Table 7. The Natural Fundamental Period affects the average coefficient of acceleration (Sa/g). The grades are M25 for concrete, Fe-415 for rebar, and Fe-345 for steel. Walls have a dead load of 14.375 KN/m and slabs of 3.75 KN/m2.

Table- 1 Structural modeling specification of G+Y Buildings

Type of Structure	RC Structure Without Infill Wall	RC Structure With Infill Walls
Bay Width in longitudinal direction	32m	32m
Bay Width in Transverse direction	24m	24m
Total Height	76.80 m	76.80 m
Live Load	3.0 KN/m2	3.0 KN/m2
Floor Finishing	1.0 KN/m²	1.0 KN/m²
Wall Load	14.375 KN/m	3.75 KN/m
Grade of concrete	M-25	M-25
Type of Rebar	Fe-415	Fe-415
Type of steel	Fe-345	Fe-345
Each floor height	3.2 m	3.2 m
Support condition	Fixed	Fixed

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V. RESULTS ANALYSIS

A. *Maximum Overturning Moments*

Maximum Overturning Moments about X Direction in KN-m of Model-I **(**G+23**)**

Table- 1 Maximum Overturning Moments in KN-m of Model-I **(**G+23**)**

MAXIMUM OVERTURNING MOMENT ALONG TO X-DIRECTION IN KN-M					
STOREY	HTS.	MODEL-I	MODEL-II	MODEL-III	MODEL-IV
Story24	76.8	0.0000024	0.0000017	0.0000011	0.0000056
Story23	73.6	42325.7754	2100.7259	2100.7198	57459.5091
Story22	70.4	143168.0416	6910.2369	6910.2218	196049.4561
Story21	67.2	301271.1945	14135.4596	14135.4277	412157.4877
Story20	64	515387.8688	23487.2684	23487.2177	702201.0748
Story19	60.8	784279.4316	34681.4811	34681.4073	1062631.384
Story18	57.6	1106716.396	47439.9949	47439.8978	1489936.764
Story17	54.4	1481478.856	61492.1887	61492.0726	1980646.471
Story16	51.2	1907356.93	76576.6214	76576.4834	2531334.607
Story15	48	2383151.234	92443.0593	92442.9055	3138624.339
Story14	44.8	2907673.359	108854.9964	108854.832	3799192.297
Story13	41.6	3479746.377	125592.6927	125592.5251	4509773.302
Story12	38.4	4098205.338	142456.8979	142456.7346	5267165.224
Story11	35.2	4761897.834	159273.3956	159273.2405	6068234.291
Story10	32	5469684.473	175898.5061	175898.3645	6909920.354
Story9	28.8	6220439.554	192225.7736	192225.6497	7789242.96
Story8	25.6	7013051.437	208193.8905	208193.7919	8703306.875
Story7	22.4	7846423.456	223796.0701	223795.9989	9649309.351
Story6	19.2	8719473.997	239090.5698	239090.5222	10624545
Story5	16	9631137.961	254212.3279	254212.3003	11626417
Story4	12.8	10580366	269384.4413	269384.4276	12652438
Story3	9.6	11566128	284928.8785	284928.8726	13700247
Story2	6.4	12587408	301272.9904	301272.9868	14767605
Story1	3.2	13643214	318951.3804	318951.3762	15852425
Base	0	14724905	338587.3791	338587.3746	16950285

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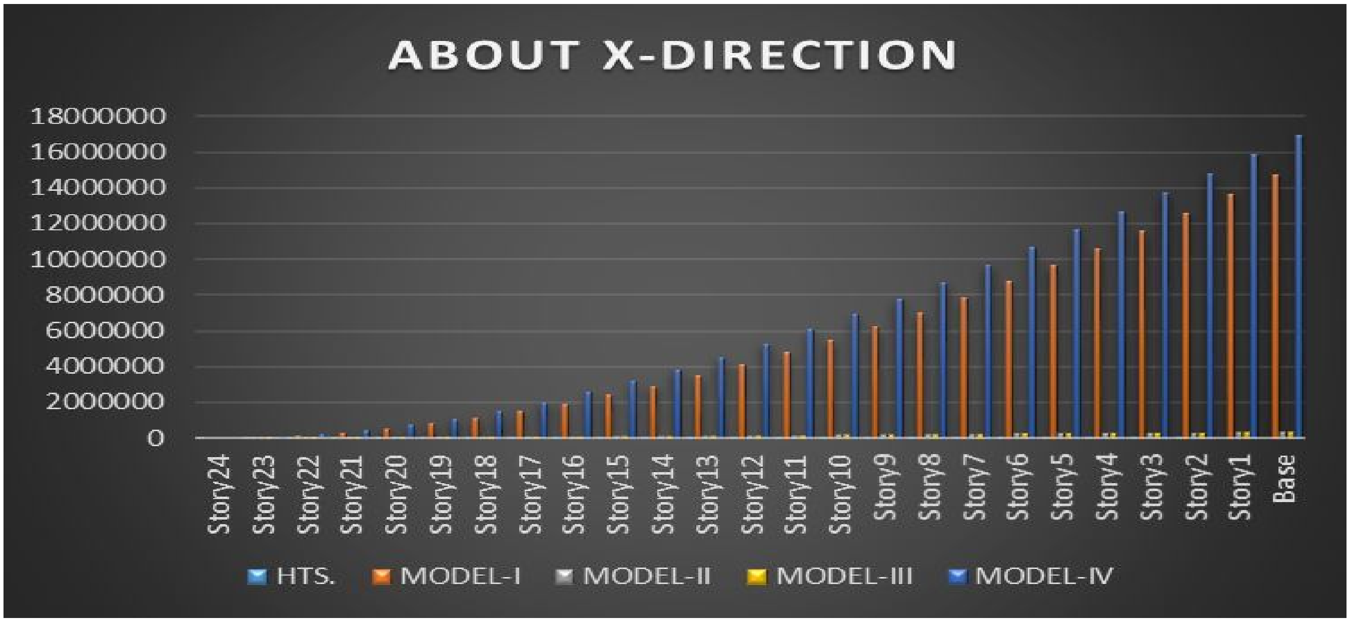

Maximum Overturning Moments about y Direction in KN-m of Model-I **(**G+23**)**

Table- 2 Maximum Overturning Moments in KN-m of Model-I (G+23**)**

MAXIMUM OVERTURNING MOMENT ALONG TO Y-DIRECTION IN KN-M					
STOREY	HTS.	MODEL-I	MODEL-II	MODEL-III	MODEL-IV
Story24	76.8	0.0000061	0.0000008	0.0000020	0.0000042
Story23	73.6	43430.6865	2809.6767	2809.6819	58201.5936
Story22	70.4	146754.6576	9296.9613	9296.9764	198319.3021
Story21	67.2	308530.8337	19084.2479	19084.261	416475.9637
Story20	64	527328.2685	31796.6757	31796.6742	708827.7144
Story19	60.8	801726.7809	47062.8646	47062.8488	1071568.954
Story18	57.6	1130317.495	64515.7793	64515.7486	1500936.447
Story17	54.4	1511703.408	83793.7211	83793.685	1993213.678
Story16	51.2	1944499.978	104541.5883	104541.5378	2544735.495
Story15	48	2427335.745	126412.2839	126412.2092	3151893.058
Story14	44.8	2958852.977	149068.5423	149068.456	3811139.063
Story13	41.6	3537708.342	172185.1746	172185.0791	4518993.306
Story12	38.4	4162573.597	195451.7192	195451.6259	5272048.492
Story11	35.2	4832136.327	218575.8607	218575.7786	6066976.464
Story10	32	5545100.658	241287.5544	241287.4874	6900534.613
Story9	28.8	6300188.088	263344.3241	263344.2673	7769572.9
Story8	25.6	7096138.183	284537.7468	284537.703	8671040.838
Story7	22.4	7931709.578	304701.78	304701.7375	9601995.619
Story6	19.2	8805680.548	323722.8217	323722.7883	10559609
Story5	16	9716850.375	341552.7048	341552.6884	11541180
Story4	12.8	10664039	358223.8827	358223.8756	12544135
Story3	9.6	11646092	373868.5191	373868.5226	13566051
Story2	6.4	12661873	388738.9317	388738.9357	14604651
Story1	3.2	13710277	403231.916	403231.917	15657831
Base	0	14783051	418250.7833	418250.7843	16721860

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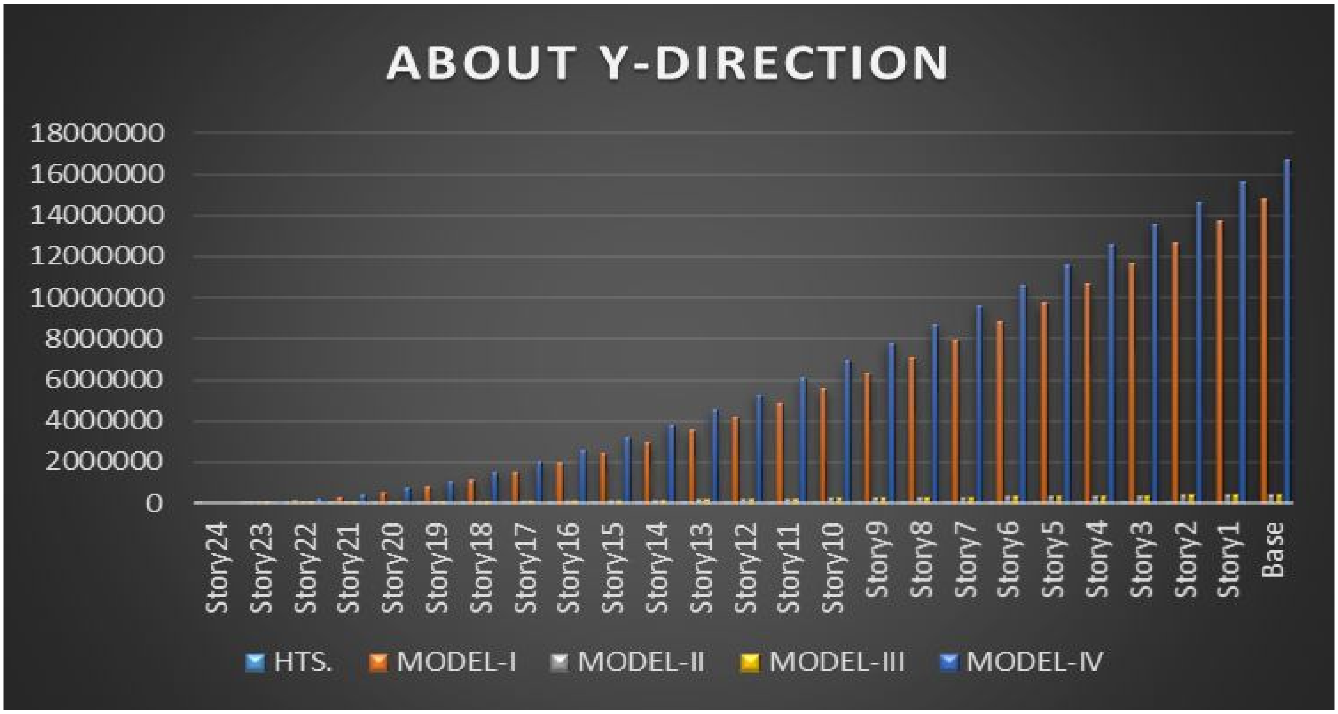
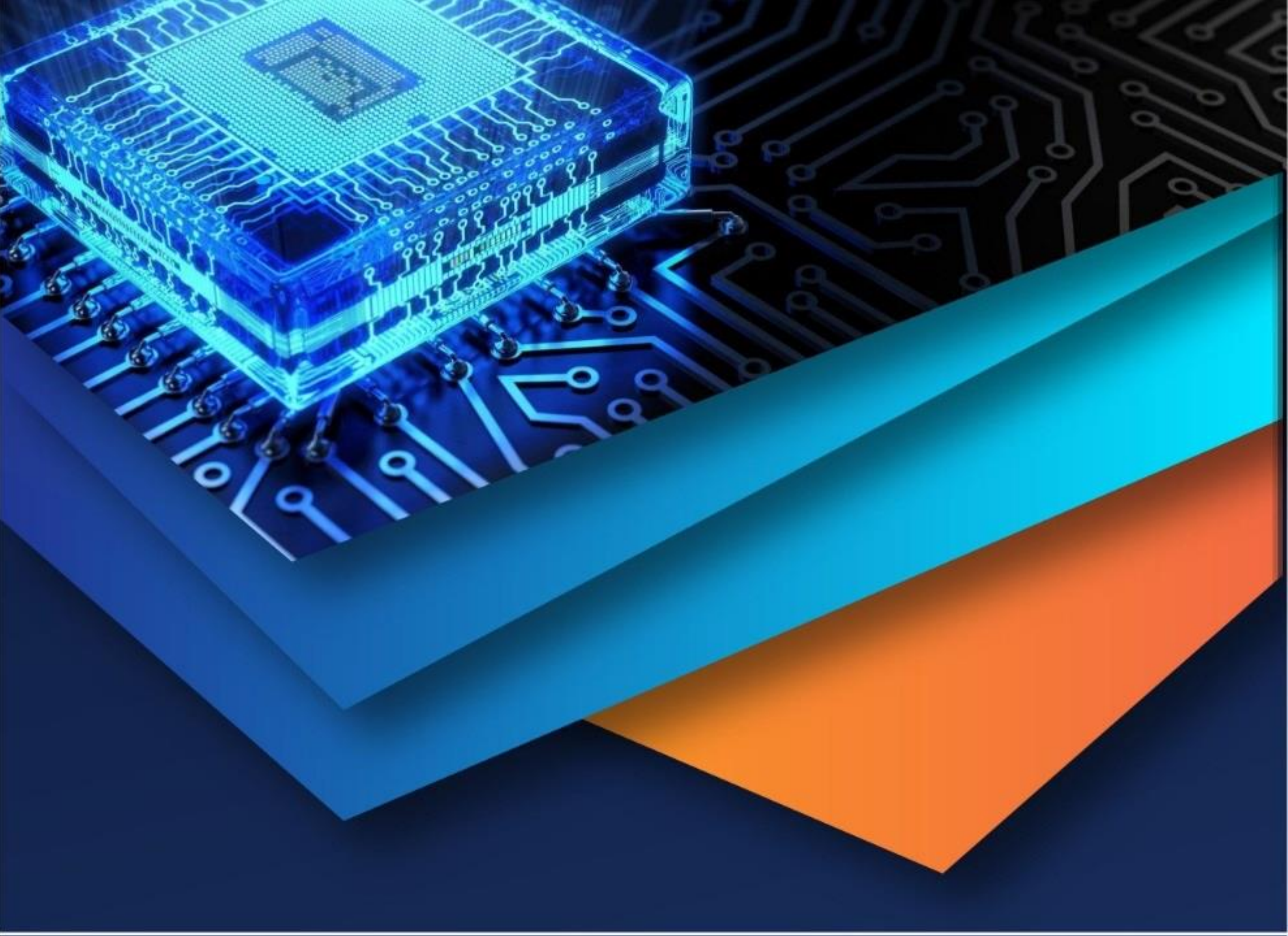


VI. CONCLUSIONS

1) It is found that the maximum storey overturning moment is at base of the structure as 14724905 KN-m in Model-I without Masonry infill structure, 338587.3791 KN-m in Model-II & Model-III of Masonry infill structure as strut eccentric back and eccentric forward as same overturning moment and 16950285 KN-m in Model-IV with masonry infill with X type of Strut and zero overturning moment at base of the structure along the X direction.
2) As comparing all the Models, the maximum overturning moment found at base of structure is 16950285 KN-m in Model-IV in with infill structure while of minimum storey overturning moment of 14724905 KN-m in Model-I which is without Masonry infill structure of X type of Strut along the X direction.
3) It is observed that, if the number of storey increased, overturning moment at base is also increased.
4) It is seen that the maximum storey overturning moment is at base of the structure as 14783051 KN-m in Model-I without Masonry infill structure, 418250.7833 KN-m in Model-II & Model-III of Masonry infill structure as strut eccentric back and eccentric forward as same overturning moment and 16721860 KN-m in Model-IV with masonry infill with X type of Strut and zero overturning moment at base of the structure along the X direction.
5) As comparing all the Models, the maximum overturning moment found at base of structure is 16721860 KN-m in Model-IV in with infill structure while of minimum storey overturning moment of 14783051 KN-m in Model-I which is without Masonry infill structure of X type of Strut along the Y direction.
6) It is seen that, if the number of storey increased, overturning moment at base is also increased.

REFERENCES

[1] Trupti S. Shewalkar and Amey R, Khedikar, "Performance Analysis of in filled RC Frames in Earthquake Region Using STAAD.Pro" IOSR Journal of Engineering (IOSRJEN) ISSN (e): 2250-3021, ISSN (p): 2278-8719 PP 66-69
[2] Shriyanshu Swarnkar and Dr. Debarati- "Analysis of Building with Infill Walls" Journal of Civil Engineering and Environmental Technology Print ISSN : 2349-8404; Online ISSN : 2349-879X; Volume 2, Number 9; April – June, 2015 pp 71 – 76 Krishi Sanskriti Publications.
[3] Mohd Abdul Malik , M A Azeem , Mohd Nazim Raza-" Effect of Infill Walls on Seismic Performance of RC Frames"- International Journal of Research and Scientific Innovation (IJRSI) | Volume V, Issue II, February 2018 | ISSN 2321–2705.
[4] Kiran Tidke , Sneha Jangave-"Seismic Analysis of Building with and Without Infill Wall"- International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 7, July 2016.
[5] S.N. Jaya Kumar, Dr. J. Rex-"Studies On Seismic Resistance Of Rcc Frames With And Without Infill Walls"- Journal of Applied Science and Computations Volume VI, Issue VI, JUNE/2019 ISSN NO: 1076-5131.
[6] IS 1893(Part 1): 2002"Criteria for Earthquake Resistant Design Of Structures Part 1 General Provisions and Buildings (Fifth Revision) Bureau of Indian Standards New Delhi.



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