International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 06 | June - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Response Spectrum Analysis of Concrete Structure using Brick Infill Material

Amit Singh*1, Dr. J N Vyas*2
*1P.G. student, Department of Civil Engineering, RGPV/Mahakal Institute of Technology And Management,Ujjain, M.P.,India
*2 Professor,Department of Civil Engineering, RGPV/Mahakal Institute of Technology and Management, Ujjain, M.P., India

Abstract: - *With a lateral-load-resisting system made up of RC frames that are masonry-infilled, the behavior of a popular building type in high seismic zones is studied in this paper. The current seismic code does not apply to older buildings of this type because they were typically constructed with a combination of insufficient or no lateral loads and gravity loads. Additionally, the original design did not take into account the role that infill panels play in the RC frames' lateral load resistance, which frequently led to an overly conservative design. There are four model of G+10 building with bare frame and strut frame structure were taken or the study. Fourdifferent building models with bay width of 6m in X-direction and story height equal to 4m were considered for this study. The structures are modeled by using computer software SAP 2000vs19. The column section defined for the frame satisfies both the requirement for strength and stiffness. All the selected models were designed with M-30grade of concrete are used and Fe-415 grade of reinforcing steel as per Indian standards.*

Keywords: *Computer, structure building, earthquakes, construction, infill material etc.*

1. INTRODUCTION

Reinforced concrete is one of the most commonly used modern building materials. Concrete is a "cast stone" made by mixing cement, sand and aggregate with water. Ready-mixed concrete can be molded into almost any shape, giving it a fundamental advantage over other materials. It became very popular after the invention of Portland cement in the 19th century. However, its limited tensile strength initially prevented its widespread use in building construction. To overcome the low tensile strength, reinforcing bars are embedded in concrete to form a composite called reinforced concrete (RC). The use of RC structures in modern society is due to the wide availability of their components, rebar and concrete. Except for steel and cement production, concrete production does not require expensive factories. However, building a building with concrete requires a certain amount of skill, expertise, and craftsmanship, especially in the areas associated with construction. Despite the need for such advanced technology and expert input, many single-family and low-rise apartment buildings around the world have been and are still being built with RC without technical assistance. Such buildings in seismic areas can be death traps. This is the motivation behind the development of this tutorial.

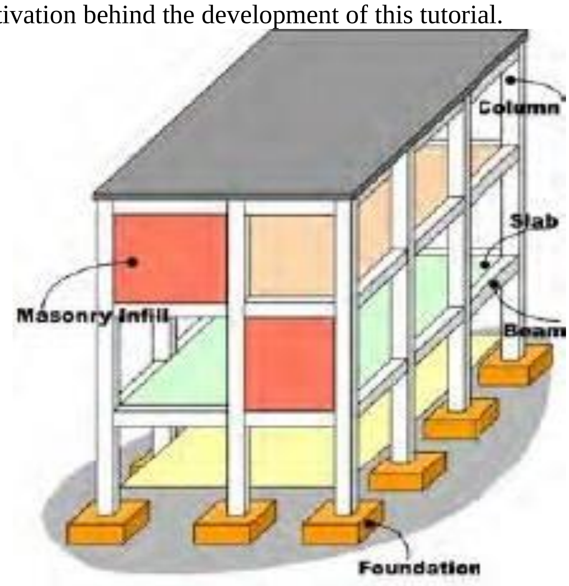

Figure 1:. A typical RC frame building with masonry infills and its components

2. PROBLEM DESCRIPTION

The concept and use of brick infill and masonry buildings pose challenges that need to be considered in their design and use. These challenges arise because many modern buildings, now and in the future, are constructed on horizontal or sloping ground using different types of infill in regular and irregular patterns. To do. Large irregularities in vertical and horizontal configuration, soil conditions, or the use of different types of infills can lead to serious problems of displacement, torsion and stress concentration, resulting in deformations and Displacement can occur. These conditions should be checked in the early stages of design to ensure that the structure is not exposed to conditions that are difficult to make safe.

3. INTEREST OF RESEARCH

The purpose of this study is to study different seismic responses of brick-filled buildings using vertical irregularities in floors of different buildings. By comparing various seismic parameters, it is possible to propose the most suitable filling building for the existing conditions. Specifically, the main goals of this study are to:

• Understand the interaction between brick-filled structures and unstable ground.

• Predict the effects of possible earthquakes.

• Design, construct and maintain brick panel structures to meet seismic load expectations and building codes. • Suggest the most appropriate building filling for the existing situation.

Of course, this study is considered a new and contributing activity in terms of knowledge development based on evaluation and validation with available recommendations for the analysis of brick-filled buildings using advanced computerized software.

4. RESEARCH AREA

The main purpose of this study is to gain knowledge and influence on the performance of brick-filled buildings under seismic loads. This work contributes to the development of an 11-story 3D brick-filled building model that realistically represents the behavior of the constructed building under static and nonlinear seismic loading conditions.

A comprehensive literature review on the issues of brickfill buildings under seismic loads was conducted to review brickfill building concepts, determine the benefits of using brickfill panels, identify related issues, and provide brickfill design and established current practices. Construction, established research work and knowledge gaps.

Current research includes the analysis of his 3D numerical model of his 11-storey brick-filled building using SAP 2000 (version 20) software to demonstrate the effectiveness of the brick-filled building under nonlinear static seismic loads. Simulate behavior and performance. Comparison of displacement and base shear results.

5. LITRATURE REVIEW

A brief review of previous studies on the application of structural composition to brick-filled masonry. This literature review also includes previous studies on various uses of stone. This literature review summarizes recent contributions to the seismic analysis of brick building structures.

Naraine and Sinha (1992) Interaction curves of masonry under cyclic and biaxial compression. Peak voltages were determined from a set of interaction curves and corresponding curves. Strain was determined from the empirical relationship between peak strain, envelope stress, and linear stress ratio. The calculated curves are in good agreement with the empirical curves obtained from experimental data.

Totoev and Nichols (1997) studied dynamic modulus. Testing bricks and masonry using the longitudinal vibration test method. Measured by the ultrasonic pulse method and compared with each Young value. Elastic modulus obtained by quasi-static loading. A similar test was also performed on mortar cubes. Derivation of elastic modulus and peak stress ratio for bricks, prisms and mortar. Niruba S (2015) A number of literature reviews show that fillers change the behavior of truss structures under lateral loads. Panel contributions are often ignored in general structural analysis. The structural impact of brick filling is often overlooked when designing supports and other components for RC frame construction. Brick walls exhibit high in-plane stiffness and contribute to frame stiffness against lateral loads. Alternatively, the lateral deflection of the filled frame is significantly reduced compared to the lateral deflection of the unfilled frame. It can be seen from this that the frame with the filling deflects significantly less than the frame without the filling. This result reflects the importance of filling to improve the strength, stiffness and frequency of the overall system. Position and amount of padding. We found that the less filling, the stiffer the system.

Fabio Di Trapani (2015), together with several researchers, has extensively investigated the problem of masonry fill joints in RC frame structures in their work over the past decades. Much interest in this topic stems from the practical observation that the response of frame structures to seismic events is highly dependent on their interactions with panel walls, which are considered non-structural elements. , is not included in the structural model. The impact of masonry filling on structural behavior is so important that it affects not only the overall strength and stiffness, but also the mechanisms by which the integrity of the entire structure collapses under the influence of strong ground movements. It's basically decided. be changed. Filled panels can positively influence the behavior of structures by compensating for lack of resistance to lateral impact or by inducing unanticipated and dangerous non-ductile collapse mechanisms. . . can occur. However, research conducted on this topic has shown that regardless of the positive or negative contribution of masonry filling to structural response, its presence in structural modeling at both the design and validation stages cannot be ignored. . . This article provides a comprehensive literature review of modeling techniques that have been developed over the last decades. This includes an advanced nonlinear FE micromodeling approach for simplified equivalent macromodels with one or more brackets using various technical code statements.

6. FRAME GEPMETRY

A G+10 building with shell and strut frame construction was used for the study. In this study, his four different building models with a field width of 6 m in the X direction and a floor height of 4 m were considered. The structure is modeled using the computer software SAP 2000vs20. Columns defined in the frame meet both strength and stiffness requirements. All selected models were designed using M-30 grade concrete and Fe-415 grade rebar in accordance with Indian standards.

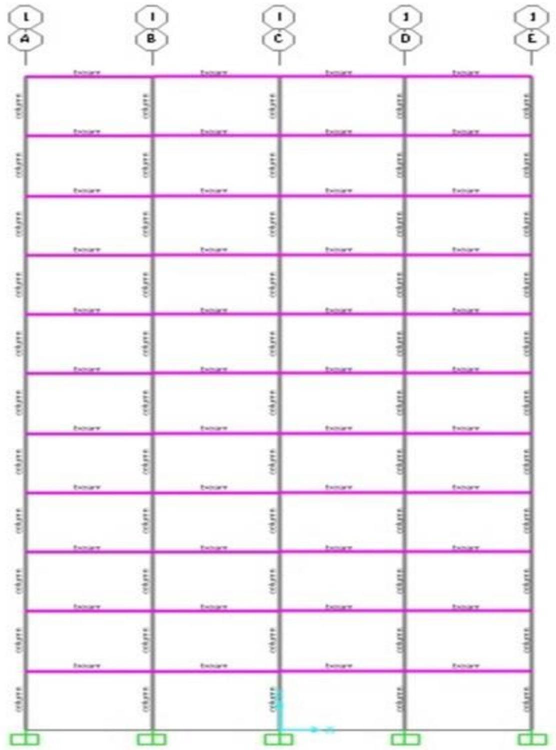

Figure 2: bare frame model

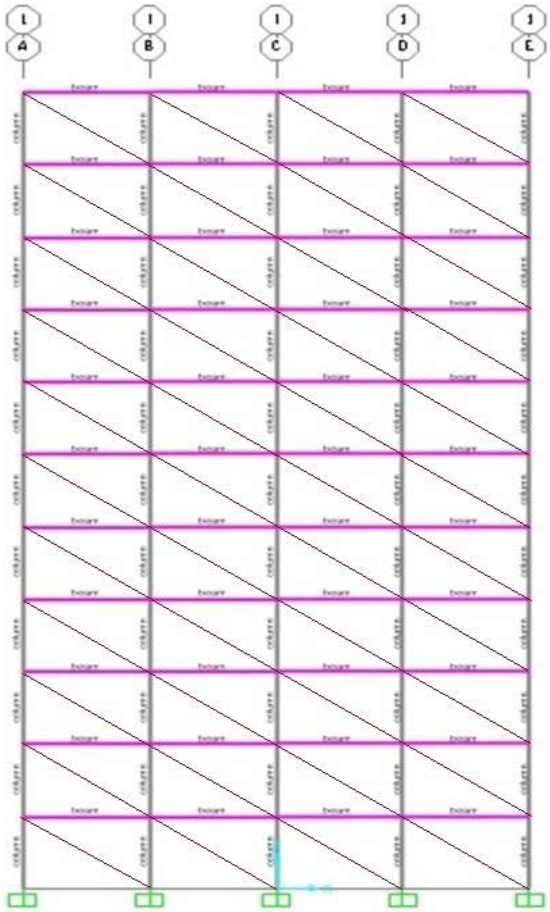

Figure 3: Model of infill structure as an equivalent strut with 2.5 % opening

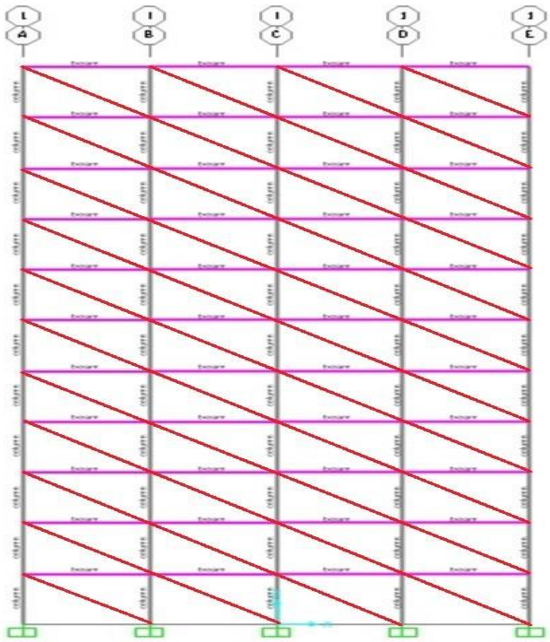

Figure 4: Model of infill structure as an equivalent strut with 5 % opening

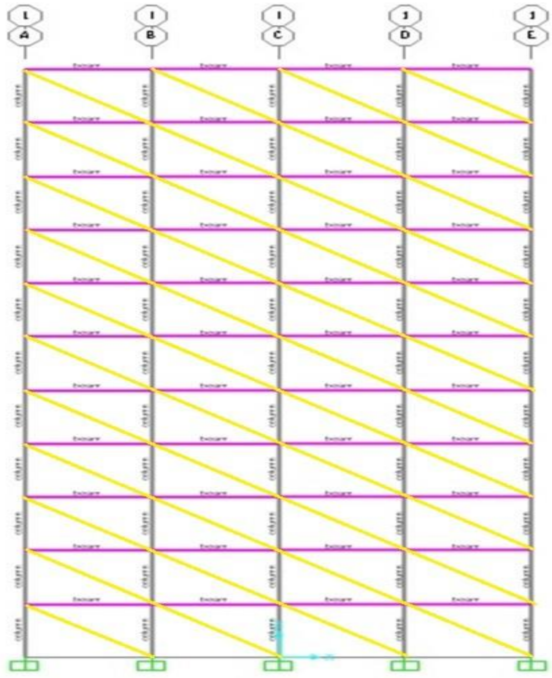

Figure 5: Model of infill structure as an equivalent strut with 10 % opening

Story No.	Story displacement (mm)			
	Model1	Model2	Model3	Model4
Story1	14.36	0.83	0.77	0.766
Story2	43.173	3.04	2.804	2.78
Story3	76.648	6.39	5.88	5.8
Story4	111.12	10.70	9.81	9.8
Story5	144.93	15.75	14.69	14.5
Story6	177.02	21.36	20.52	19.8
Story7	206.467	27.36	26.97	25.6
Story8	232.298	33.60	34	31
Story9	253.56	39.97	41.43	38
Story10	269.47	46.37	48.92	44
Story11	280.07	52.74	56.30	50.61

7. RESULT AND DISCUSSION

The results obtained from SAP 2000 software package are used for the Numerical results given below, the procedure to obtain the results on SAP given on the chapter 3 The SAP program must be first verified in order to ensure the subsequent analyses are free of error. Therefore the result obtained from the analysis is compared with available results of references.

According to IS 1893 seismic analysis is done and following results are obtained.

Table 1: Base reaction of all models

		Model1	Model2	Model3	Model4
Base shear (kN)		300.637	248.616	238.117	266.13

8. CONCLUSIONS

Infill panels that are too weak promote structural displacement but reduce the strength and stiffness of RC buildings. Moreover, the presence of pads reduces the strength of the structure and also reduces the ductility of the embryo. Foundation beam foundations are very important when considering the contribution of fillers to building design. The presence of structurally filled walls tends to reduce the damage inflicted on the same RC member in an eastern earthquake. Columns, beams, and panels on lower stories are more susceptible to damage than those on upper stories. Seismic weight of bare frame building is found to be always less than that of similar infill building.

- The seismic weight of building is found to be varying with length. The change in weight of the structure due to the use of open section of infill structure. According to the load carrying capacity of member element.

- Also, as the Equivalent strut introduced in models displacement and storey drift decreases in models.
- From analysis of models finds that base reaction of model 2 (Brick infill structure with opening 5%) is 79.20%, 96.01% and 89.5% of model 1, model 2 and model4 because of using brick as a infill strut to reduce base shear of building.
- The seismic analysis of models done according to IS 1893-2016 shows that the increase in dead load of the structure attracts baser shear force which increase the storey shear distribution force of the structure.
- The response spectrum analysis is done with IS1893 code for zone v^{th} shows that placing of infill equivalent strut at corner of the structure reduces spectral acceleration

9. REFERENCES

1. SANEINEJAD, A. and HOBBS, B. Inelastic design of infilled fsames, Journal of Structural Pngineering, 1995, ASCP, Vol 121, No 4, 634-650.
2. REINHORN, A.M., MADAN, A., VALLES, R.E., REICHMANN, Y., and MANDER, J.B. Modelling of masonry infill panels for structural analysis, Technical Repost NCEER- 95-0018, National Centes fos Easthquake Engineesing Reseasch, Buffalo, 1995.
3. _CSI SAP2000: /ntegrated finite element analysis and design of structures, Computess and Stsuctuses Inc., Califosnia, 1999.
4. DAS,D. and MURTY, C.V.R. Bsick masonsy infills in seismic design of RC fsame buildings : Past 1 – Cost implications, Γhe /ndian Concrete Journal, July 2004, Vol 78, No 7, pp. 39-44.
5. _Seismic evaluation and retrofit of concrete buildings, ATC 40, Applied Technology Council, Califosnia, 1996.
6. PARK,R., and PAULAY, T. Reinforced Concrete Structures, John Wiley and Sons,New Yosk,1975.
7. DASGUPTA, P. Pffect of confinement on strength and ductility of large RC hollow sections, M.Tech. Thesis, Depastment of Civil Engineesing, Indian Institute of Technology Kanpus, 2000.
8. PILLAI, E.B.P. /nfluence of brick infill on multistorey multibay R.C. frames, Ph.D. Thesis, Depastment of civil engineesing, Coimbatose Institute of Technology, Coimbatose, 1995.
9. HATZINIKOLAS, M.A. Relationship between allowable and ultimate shear stresses in unreinforced brick masonry, Canadian Masonsy Reseasch Institute, Pessonal Communication, 2000.
10. _/ndian standard code of practice for structural use of unreinforced masonry, IS 1905 : 1987, Buseau of Indian Standasds, New Delhi, 1987.
11. DAS, D. Beneficial effects of brick masonry infills in seismic design of RC frame buildings, M.Tech. Thesis, Depastment of Civil Engineesing, Indian Institute of Technology Kanpus, 2000.
12. RAJ, G.B.P. Pxperimental investigation of RC Prames with brick masonry infill walls having central opening subjected to cyclic displacement loading, M.Tech. Thesis, Depastment of Civil Engineesing, Indian Institute of Technology Kanpus, India,2000.
13. _Structural engineering design provisions, UBC 1997, Unifosm Building Code, 1997, Vol 2.
14. NBC (National Building Code). 1994b. Mandatory rules of thumb: reinforced concrete buildings with masonry infill. NBC 201, Government of Nepal, Babar Mahal,Kathmandu.
15. NBC (National Building Code). 1994c. Mandatory rules of thumb: reinforced concrete buildings without masonry infill. NBC 205, Government of Nepal, Ministry of Physical Planning and Works,Kathmandu.
16. NPC (National Planning Commission). 2015. Nepal Earthquake 2015: Post Disaster Needs Assessment. Government of Nepal,Kathmandu.
17. Petrus C, Stoian V, Marius M, Anastasiadis A. 2015. Reinforced concrete frames with masonry infills. Out of plane experimental investigation. Act TechnicalNapocensis.
18. Preti M, Migliorati L, Giuriani E. 2015. Experimental testing of engineered masonry infill walls for post-earthquake structural damage control. Bulletin of Earthquake Engineering, 13(7):2029-2049 35. Ricci P, De Luca F, Verderame G. 2011. 6th April 2009 L'Aquila earthquake, Italy: reinforced concrete building performance. Bull Earthq Eng,9:285–305.
19. Ricci P, Di Domenico M, Verderame GM. 2018. Experimental investigation of the influence of slenderness ratio and of the in-plane/out-of-plane interaction on the out of-plane strength of URM infill walls. Construction and Building Materials, 191:507-522.
20. Sharma K, Kc A, Subedi M, Pokharel B. 2018. Post Disaster Reconstruction after 2015 Gorkha Earthquake: Challenges and Influencing Factors. J. Inst. Eng. 14,52–63.
21. Silva L, Vasconcelos G, Lourenço P, Akhoundi F. 2016. Experimental evaluation of a constructive system for earthquake resisting masonry infill walls. In Brick and Block Masonry Conference (IB2MAC), Padua, Italy,2016.
22. Vailati M, Monti G, Di Gangi G. 2017. Earthquake-safe and energy-efficient infill panels for modern buildings. In: International conference on earthquake engineering and structural dynamics. Springer, Cham, pp233–261.
23. Varela-Rivera J, Moreno-Herrera J, Lopez-Gutierrez I, Fernandez-Baqueiro L. 2012a.Out-of- Plane strength of confined masonry walls. J. Struct. Eng., 138;1331–1341.
24. Varela-Rivera J, Polanco-May M, Fernandez-Baqueiro L, Moreno EI. 2012b. Confined masonry