

Research Article

Comparative Analysis of Structural Response of Multi-storey Reinforced Concrete Framed Building with Different Infill Wall Materials

Bimal Ojha¹, Prabin Pokharel¹, Sabin Khatri¹, Padam Karki¹, Binaya Jamarkattel¹, Abhinesh Khatri², Hari Ram Parajuli^{3,*}

¹Department of Civil Engineering, Institute of Engineering Thapathali Campus, Kathmandu, Nepal

²Department of Civil Engineering, Kantipur Engineering College, Lalitpur, Nepal

³Department of Civil Engineering, Institute of Engineering Pulchowk Campus, Kathmandu, Nepal

Abstract

This study evaluates the seismic performance of reinforced concrete (RC) frame structures with different infill materials using analytical modeling techniques. Five types of infill- common burnt clay bricks, AAC blocks, gypsum board, lime-based solid blocks, hollow concrete blocks -were considered to assess their impact on key seismic response parameters such as base shear, displacement, time period, and minimum beam-column sizes. Finite element modeling was performed using ETABS v20, with infills idealized as equivalent diagonal struts based on their material properties and stiffness characteristics. Response spectrum analysis were employed to simulate structural behavior under seismic loading. Results show that brick-infilled frames and concrete blocks exhibit higher stiffness but also higher seismic mass, resulting in increased base shear and structural member sizes. AAC blocks significantly reduce base shear and fundamental time period due to their light weight, though they lead to increased lateral displacement. Lime-based solid blocks demonstrated a balanced performance, offering reduced seismic demand, moderate stiffness, and controlled displacements while maintaining sustainable construction benefits. The overall analysis demonstrates that the lighter infill materials like AAC and gypsum reduce base shear, they may permit excessive lateral deformation. Conversely, denser materials improve lateral stiffness but increase seismic demand. Therefore, in earthquake-prone regions like Nepal, where both seismic safety and cost-efficiency are vital, the infill wall material must be selected based on a balance between displacement control and seismic force minimization. Further research is recommended in areas such as effects on asymmetrical buildings, experimental validation, non-linear interaction modeling, and the development of hybrid infill systems for optimized structural and environmental outcomes.

Keywords

Infill Wall Materials, RCC Framed Building, Equivalent Diagonal Strut

*Corresponding author: hari.parajuli@ioe.edu.np (Hari Ram Parajuli)

Received: 2 June 2025; **Accepted:** 4 June 2025; **Published:** 15 August 2025



Copyright: © The Author(s), 2025. Published by Science Publishing Group. This is an **Open Access** article, distributed under the terms of the Creative Commons Attribution 4.0 License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

1. Introduction

Reinforced concrete (RC) framed structures are the most common form of construction in urban and semi-urban areas of Nepal, especially for residential, commercial, and institutional buildings. In most cases, these frames are combined with masonry infill walls, typically made of clay bricks, concrete blocks, or more recently, autoclaved aerated concrete (AAC) blocks. While these infill walls are primarily intended for partitioning and enclosing spaces, they inadvertently influence the structural response of the building [1]. Traditional materials such as fired clay bricks and concrete blocks offer high stiffness and compressive strength; however, they also contribute to increased seismic mass, thereby amplifying base shear forces during an earthquake [2]. In contrast, modern alternatives like autoclaved aerated concrete (AAC) blocks, gypsum boards, and lime-based solid blocks offer various benefits such as reduced self-weight, enhanced thermal insulation, and cost-effectiveness [3]. The light weight infill model is having significantly smaller base shear as compared with other infill models which results in decrease in reinforcement to resist member forces, hence economy in construction can be achieved [4].

This research primarily focuses on reduced dead load on RCC framed structure due to various infill wall alternatives like common brunt clay bricks, AAC blocks, gypsum board, lime-based solid blocks, hollow concrete blocks etc as it directly influences the dimensions of structural elements such as beams and columns, as well as the building's time period,

displacement, and base shear. Despite their structural influence, infill walls are frequently treated as non-structural components and are often ignored in analytical models. However, evidence from recent earthquakes, particularly the 2015 Gorkha Earthquake, has shown that infill walls play a crucial role in altering the dynamic characteristics of buildings [5, 6]. Unreinforced masonry Infills modify the behavior of framed structures under lateral loads; however, in practice, the infill stiffness is commonly ignored in frame analysis, resulting in an under-estimation of stiffness and natural frequency [7].

To capture the influence of infill walls in analysis, the equivalent diagonal strut model is used which replaces the infill panel with one or more diagonal compression-only struts between beam-column joints [8].

In this study, a comparative analysis is performed using ETABS v20 software to model three multi-storey RC framed buildings viz (G+2, G+5, G+8) with various types of masonry infill walls. The infill is incorporated using the equivalent diagonal strut approach. The study compares the seismic responses-base shear, displacement, inter-storey drift, natural period, and storey stiffness-of buildings with five different infill materials such as common brunt clay bricks, AAC blocks, gypsum board, lime-based solid blocks, and hollow concrete blocks. All analyses conform to seismic provisions of the IS 1893: 2016 [9] and include modal and response spectrum analysis.

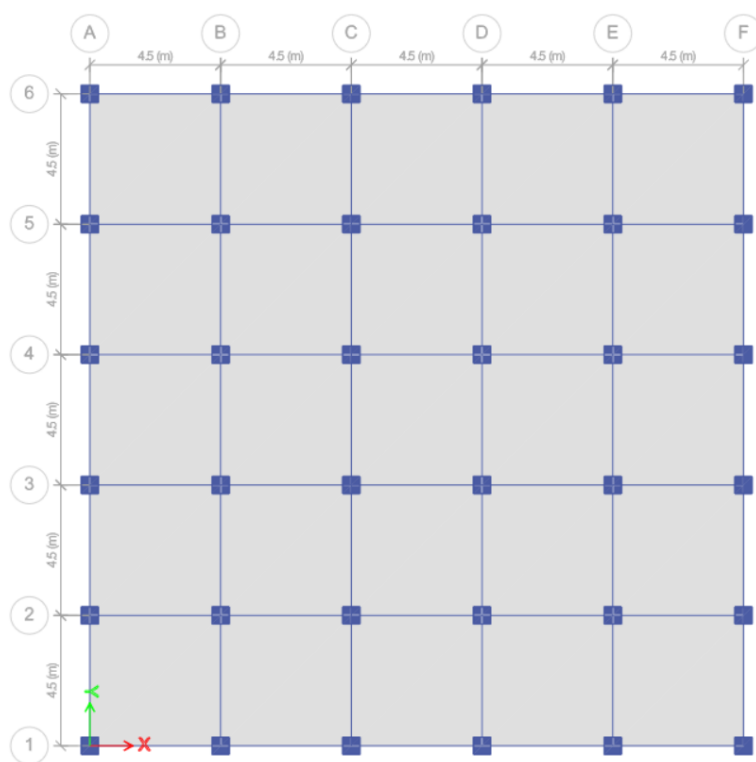


Figure 1. Plan of building.

This research aims to provide insights into how infill material type affects overall structural performance by comparing base shear, displacement, and the required sizes of beams and columns across different building heights and infill materials which in results provide valuable insights into optimizing structural design for safety and efficiency in high seismic zones. The findings will be valuable for structural engineers and code developers in Nepal and other earthquake-prone regions with similar construction practices.

2. Objectives

The objective of this research is to:

- 1) Compare the structural parameters such as time period, maximum storey displacement and base shear across various infill materials in different storey buildings.
- 2) Determine the minimum beam and column sizes required for different infill wall materials under standard

conditions.

3. Methodology

In this study, a simplified square plan configuration of three different storey (G+2, G+5 and G+8) with dimensions of 22.5m x 22.5m was used to model the building with exterior brick walls of 230 mm thickness. The interior partition walls are modeled with five different infill material viz common brunt clay bricks, AAC blocks, gypsum board, lime-based solid blocks and hollow concrete blocks. It is assumed that all walls are non-load bearing, and their effects on the structural response are considered negligible except for their contribution to the dead load of the building. This means that while the dead load from the infill walls is factored into the analysis, other potential effects such as lateral load distribution and interaction with the structural frame are not considered in this study.

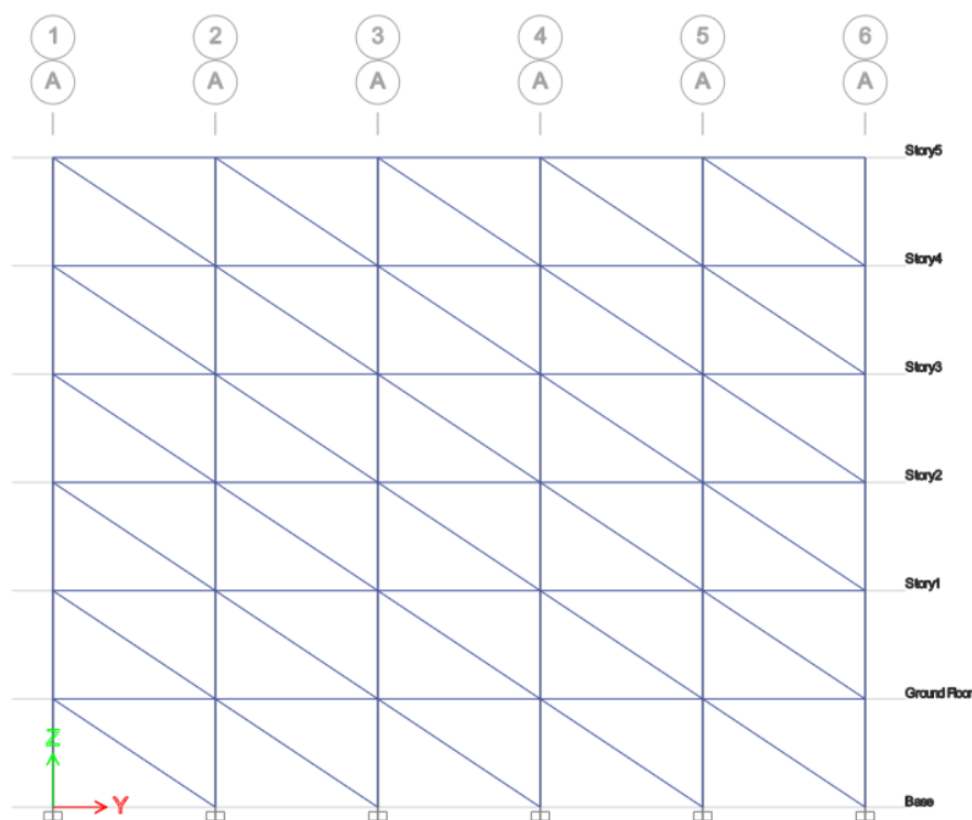


Figure 2. Elevation of building (G+5) with diagonal strut model.

A literature review was conducted to select various infill materials for the study. The densities of these infill materials were determined based on the guidelines provided in IS Code

IS 875 Part 1 as well as from relevant research papers reviewed during the literature review.

The infill wall materials consider are as follows:

Table 1. Showing properties of different infill wall materials as per IS 875: part 1) [10].

Infill Material	Unit weight	Advantages	Disadvantages
Common burnt clay Bricks	19.2 kN/m ³	1) High durability and strength. 2) Good thermal insulation properties. 3) Widely available and well understood in construction practices.	1) Heavier than many modern alternatives, increasing the dead load on the structure. 2) Manufacturing involves high energy consumption and carbon emissions.
AAC Blocks	4.5 -5 kN/m ³	1) Lightweight, reducing the dead load on the structure. 2) Excellent thermal and sound insulation properties. 3) Fire-resistant and easy to work with, leading to faster construction.	1) Lower strength compared to traditional bricks. 2) Higher cost and limited availability in some regions.
Hempcrete	2.94 - 5.9 kN/m ³	1) Highly sustainable and environmentally friendly. 2) Excellent thermal and acoustic insulation. 3) Lightweight reducing the structural load.	1) Lower compressive strength, making it unsuitable for load-bearing applications. 2) Requires protection from moisture, as it is susceptible to water damage.
Gypsum Board	7.3 - 10.27 kN/m ³	1) Lightweight and easy to install. 2) Provides a smooth finish suitable for painting or wallpapering. 3) Fire-resistant and provides good sound insulation.	1) Not suitable for exterior use due to poor resistance to moisture. 2) Lower strength compared to traditional masonry materials.
Lime-Based Solid Blocks	8.65 - 12.55 kN/m ³	1) Durable and strong, suitable for load-bearing walls. 2) Environmentally friendly, as lime production has a lower carbon footprint than cement. 3) Good thermal properties and resistance to mold and pests.	1) Heavier than some modern materials like AAC blocks. 2) Requires skilled labor for proper construction, as the material has different handling properties compared to cement.

The loads considered during the study are as follows:

- 1) Dead load [IS 875(part 1): 1987] [10].
- 2) Live load [IS 875(part 2): 1987] [11].

3) Seismic load [IS 1893 (part 1): 2016] [9].

The structural modelling was done in ETABS v20 with the following details:

Table 2. Description of Building.

Attribute	Description
Height of storey	3m
Plinth area	22.5m*22.5m
Slab thickness	150mm
Grade of rebar	Fe500
Grade of concrete	M20
Live load on floor	3 kN/m ²

Table 3. Details of Seismic Parameters.

Coefficient for Earthquake load	Value
Seismic Zone factor	0.36
Response reduction factor	5
Soil type	Medium
Importance factor	1

Table 4. Density of Infill wall material and Line Load.

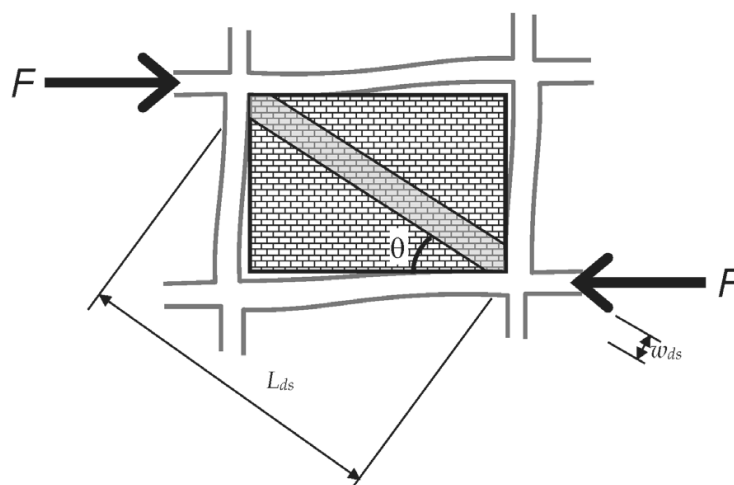
In-fill wall material	Unit weight (kN/m ³)	Thickness of wall (m)	Line load (kN/m)
Bricks	19.2	0.115	6.62
AAC Blocks	5	0.15	2.25
Hempcrete	4.4	0.15	1.98
Gypsum Boards	8.785	0.03	0.79
Lime based solid blocks	10.6	0.1	3.18

A macro finite element (FE) modeling approach was adopted in this study to examine the effect of infill walls on the structural behavior of reinforced concrete (RC) structures. Specifically, the equivalent diagonal strut model was employed to simulate the infill walls. End releases were employed for the struts in ETABS v20 in order to realistically simulate the behavior by having them subjected to only compressive loads and not tensile loads. The width of equivalent diagonal strut is calculated according to IS 1893(part I): 2016 [9].

$$w_{ds} = 0.175 \alpha^{-0.4} L_{ds}$$

$$\text{where, } \alpha = h \sqrt{\frac{E_m t \sin 2\theta}{4 E_f I_c h}}$$

E_m and E_f are the moduli of elasticity of the materials of the unreinforced masonry (URM) infill and reinforced concrete moment resisting frame (RC MRF) respectively, I_c is the moment of inertia of the adjoining column, t is the thickness of masonry infill wall and θ is the angle of diagonal strut with the horizontal.

**Figure 3.** Equivalent diagonal strut of URM infill wall (IS 1893: part -1: 2016).

The modulus of elasticity E_m (in Mpa) of masonry infill wall is given by

$$E_m = 550 f_m$$

where f_m is the compressive strength of masonry prism ob-

tained after test as per IS 1905 or given by expression

$$f_m = 0.433 f_b^{0.64} f_{mo}^{0.36}$$

where f_b and f_{mo} are compressive strength of brick and mortar respectively in MPa.

Table 5. Width of diagonal strut in mm for different infill materials and building configuration.

Infill material	Storey	Width of diagonal strut in mm
Hollow concrete blocks	G+2	603
	G+5	698
	G+8	768
Common burnt clay bricks	G+2	634
	G+5	735
	G+8	808
Gypsum partition block	G+2	618
	G+5	714
	G+8	789
Lime based solid blocks	G+2	663
	G+5	766
	G+8	845
AAC blocks	G+2	618
	G+5	712
	G+8	791

4. Results and Discussion

The structural response of multistorey RCC framed building modelled with different infill wall materials: common burnt clay bricks, AAC blocks, gypsum board, lime-based solid blocks and hollow concrete blocks is presented in this section. All models were analyzed using ETABS v20 under the seismic loading

conditions as per IS 1893 (part 1): 2016. The key performance parameters examined include fundamental time period, base shear, inter-storey drift, storey displacement, stress on beams and columns etc. Results are presented in tabular and graphical formats, highlighting the comparative influence of each infill material on seismic behavior.

4.1. Fundamental Time Period

Table 6. Fundamental time period (in seconds) for different infill-wall materials and building configuration.

SN	Infill- Wall material	G+2	G+5	G+8
1	Hollow concrete blocks	0.711	0.98	1.31

SN	Infill- Wall material	G+2	G+5	G+8
2	Common brunt Clay Bricks	0.727	1.02	1.335
3	Gypsum partition block	0.751	1.039	1.362
4	Lime based solid blocks	0.753	1.042	1.368
5	AAC blocks	0.781	1.073	1.39

The fundamental time period of a structure is a key indicator of its dynamic characteristics, directly influenced by its mass and stiffness. In this study, the time periods were obtained from modal analysis in ETABS for buildings with varying storey heights (G+2, G+5, and G+8) and different infill wall materials. The results are summarized in Table 6.

As expected, the time period increased with the number of storeys, owing to the increased mass and flexibility. For each storey level, the type of infill wall significantly influenced the time period. In general, denser and stiffer infill materials, such as hollow concrete blocks and brick masonry, resulted in lower time periods compared to lighter infill such as AAC blocks and gypsum partition blocks. Among all materials, hollow concrete blocks consistently yielded the lowest fundamental time periods across all configurations-0.711 s (G+2), 0.980 s (G+5), and 1.310 s (G+8). On the other hand, buildings with AAC block infill exhibited the highest time periods, reaching 0.781 s, 1.073 s, and 1.390 s respectively. This trend confirms that lighter, less stiff infill materials contribute to increased structural flexibility. These findings align with past studies that demonstrated the reduction of time period with the use of stiffer infill materials [12].

4.2. Optimal Beam and Column Sizes Requirement

The selection of appropriate beam and column dimensions is critical for ensuring adequate strength, stiffness, and ductility in reinforced concrete (RC) frames, particularly under seismic loading. The presence and type of infill walls significantly influence these requirements by altering the distribution of lateral forces and modifying the dynamic behavior of the structure. This study evaluated the optimum beam and column dimensions for G+2, G+5, and G+8 storey buildings using five types of infill wall materials: hollow concrete blocks, burnt clay bricks, gypsum partition blocks, lime-based solid blocks, and AAC blocks. The reinforcement in beam and column for each five infill wall materials was taken constant.

4.2.1. Optimal Beam Size Requirement

Table 7 compares the minimum beam sizes required for buildings with five different infill wall materials across three building configurations (G+2, G+5, and G+8). The beam in ground floor (GF) is taken as critical beam. The dimensions represent depth × width in mm, determined through analysis of structural demands. The trend shows that as the number of storeys increases, larger beam sizes are required to satisfy strength and deflection criteria under seismic loading.

Table 7. Minimum Beam Size for different Materials.

S. N	Infill- Wall material	Optimum beam size (mm) (Depth X Width):		
		G+2	G+5	G+8
1	Hollow concrete blocks	355x235	440x290	465x310
2	Common brunt Clay Bricks	350x235	430x290	460x305
3	Gypsum partition block	310x205	380x255	410x275
4	Lime based solid blocks	310x205	375x250	400x270
5	AAC blocks	300x200	360x240	380x255

For all storey levels, hollow concrete blocks and brick infill systems demanded relatively larger beam sizes, with maximum dimensions reaching 465 × 310 mm and 460 × 305 mm respectively in the G+8 building. These infill materials have higher stiffness and mass, thereby increasing the base shear and bending moment demands on beams.

Conversely, buildings modeled with AAC blocks required the smallest beam sizes across all configurations, with minimum sections of 300 × 200 mm for G+2 and 380 × 255 mm for G+8. This can be attributed to their lightweight and lower stiffness, which reduce lateral force demands but also result in higher structural flexibility, as discussed in the previous sub-

section.

4.2.2. Optimal Square Column Size Requirement

Table 8 outlines the minimum column dimensions needed for each infill wall material across the three building configurations. The interior column in ground floor (GF) is taken as critical column since it is expected to take more load. Column sizes are expressed as square dimensions in millimeters. The results indicate that column dimensions increase with the building height due to greater axial and lateral load accumulation.

Table 8. Minimum Square Column size obtained after analysis.

S. N	Infill- Wall material	Optimum column size (mm):		
		G+2	G+5	G+8
1	Hollow concrete blocks	340	490	610
2	Common burnt Clay Bricks	335	480	600
3	Gypsum partition block	315	455	570
4	Lime based solid blocks	310	450	560
5	AAC blocks	300	440	555

For each configuration, hollow concrete block infill resulted in the largest column sizes-up to 610 mm for G+8 structures-attributed to the increased base shear and structural stiffness they induce. Similarly, brick masonry also required relatively large sections. In contrast, AAC block infill, being lightweight and flexible, imposed lesser demands on column dimensions, requiring a minimum of 300 mm in G+2 and 555 mm in G+8.

These results highlight the trade-off between stiffness and seismic demand: stiffer infill materials improve structural rigidity but transfer greater forces to vertical load-bearing elements, necessitating more robust member sizes. Lighter infill materials reduce this demand but may compromise on lateral drift control and ductility unless compensated elsewhere in the design.

4.3. Maximum Base Shear

The magnitude of base shear depends significantly on the stiffness and mass of the structure, both of which are influenced by the type of infill wall material used. Table 9 and Figure 4 presents the maximum base shear values for buildings with different infill wall materials across G+2, G+5, and G+8 configurations. The data clearly indicate that buildings with hollow concrete block and brick infill experienced the highest base shear values, with a peak of 5102.28 kN in the G+8 configuration with hollow blocks. These materials are heavier and stiffer, increasing the effective mass and lateral stiffness of the system, thereby attracting higher seismic forces.

Table 9. Maximum Base Shear for different Materials for G+2, G+5 and G+8.

S. N	Infill- Wall material	Base shear (kN)		
		G+2	G+5	G+8
1	Hollow concrete blocks	2350.55	3801.33	5102.28
2	Common burnt Clay Bricks	2349.31	3742.21	4962.30

S. N	Infill- Wall material	Base shear (kN)		
		G+2	G+5	G+8
3	Gypsum partition block	1723.30	3314.99	4326.32
4	Lime based solid blocks	1642.76	3142.68	3819.03
5	AAC blocks	1551.30	2937.34	3251.67

On the other hand, AAC blocks resulted in the lowest base shear, with values ranging from 1551.30 kN (G+2) to 3251.67 kN (G+8), due to their lower density and relatively flexible

behavior. Intermediate values were observed for gypsum partition and lime-based blocks, which are lighter than traditional masonry but offer moderate stiffness.

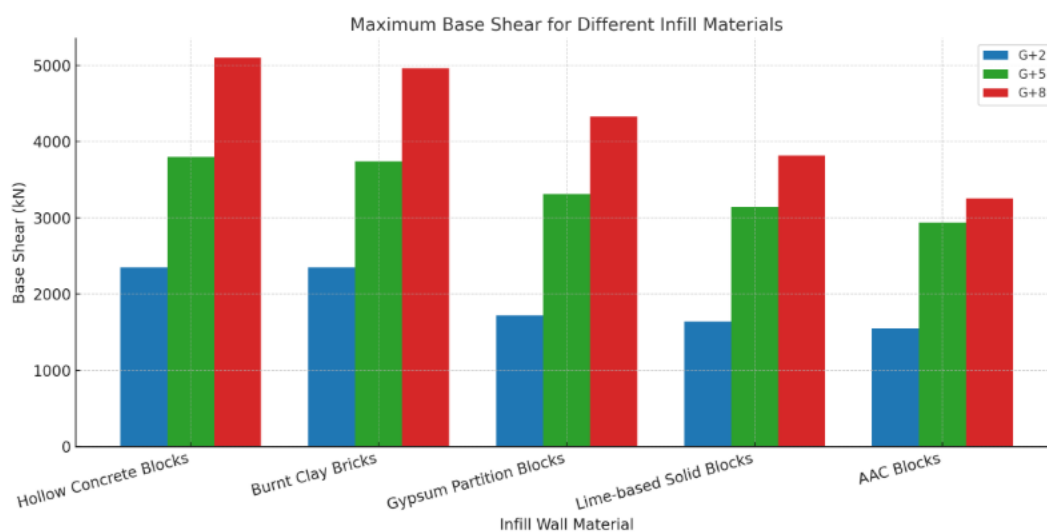


Figure 4. Maximum base shear values for G+2, G+5, and G+8 storey RC framed buildings with different infill wall materials.

These findings reaffirm the necessity of considering infill wall characteristics during the design phase. Overlooking their impact could lead to either underestimation of base shear for stiff infill materials or overdesign in the case of lighter partitions.

4.4. Maximum Storey Displacement

Maximum storey displacement reflects a structure's flexi-

bility and its potential drift under lateral loads. The building codes impose limits on lateral displacements to ensure structural integrity and human safety during earthquakes. This study assessed the maximum storey displacements for G+2, G+5, and G+8 reinforced concrete framed buildings, modeled in ETABS, with various infill wall materials using the equivalent diagonal strut model. The maximum storey displacement was observed in top floor for all cases. The results are summarized in Table 10 and visualized in Figure 5.

Table 10. Maximum Storey displacement for different Materials for G+2, G+5 and G+8.

S. N	Infill- Wall material	Maximum Top Storey Displacement (mm)		
		G+2	G+5	G+8
1	Hollow concrete blocks	1.30	3.91	6.27
2	Common burnt Clay Bricks	2.41	7.33	10.29

S. N	Infill- Wall material	Maximum Top Storey Displacement (mm)		
		G+2	G+5	G+8
3	Gypsum partition block	4.39	14.07	22.78
4	Lime based solid blocks	4.41	11.85	29.57
5	AAC blocks	3.24	9.09	19.67

Hollow concrete block infill consistently produced the least displacement, owing to the high stiffness imparted by the infill. In G+8 buildings, the displacement was limited to 6.27 mm, showing its effectiveness in controlling lateral movement. Burnt clay brick infill, although also stiff and dense, showed slightly higher displacement values than hollow blocks, reaching 10.29 mm in G+8. Gypsum partition and AAC blocks, being more flexible and lightweight, led to significantly higher storey displacements. For example, gypsum partition blocks caused a displacement of 22.78 mm in G+8 structures.

Surprisingly, lime-based solid blocks, despite being denser than AAC, resulted in the highest displacement (29.57 mm) for G+8. This may be due to a complex interaction of stiffness and mass contributing to dynamic amplification in taller structures.

In taller structures (G+5 and G+8), the displacement differences between infill types become more pronounced, emphasizing the importance of appropriate material selection for seismic safety. Buildings with more deformable infill walls may require additional seismic bracing or shear walls to keep displacements within code-prescribed limits.

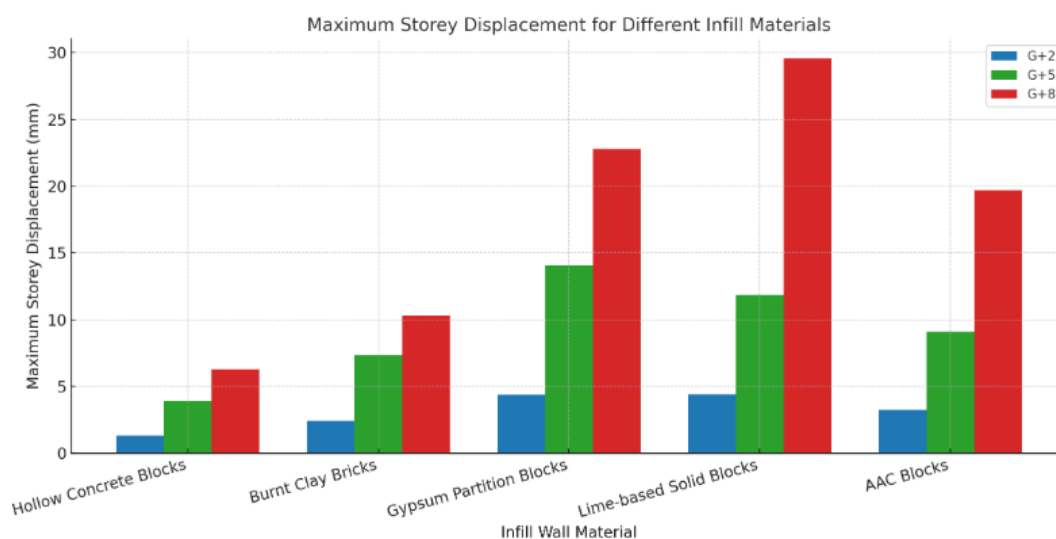


Figure 5. Maximum storey displacement for different number of floors with various materials in infill walls.

5. Conclusion

The study highlights the significant impact of infill materials on the seismic performance of RCC framed structures. Some of the conclusion that can be drawn from this research are summarized below:

- 1) Conventional brick infill and hollow concrete blocks, while offering high stiffness and compressive strength, leads to increased seismic mass, which in turn elevates base shear forces and fundamental time periods.
- 2) Optimum beam-column size requirements were found to

be most demanding in the brick-infilled models and hollow concrete block models, whereas models with AAC and lime-based blocks required comparatively smaller cross-sectional dimensions.

- 3) Heavier infills results in the need for larger beam and column sizes to maintain structural safety, ultimately increasing construction cost and material usage.
- 4) Time period analyses further confirm that heavier infills result in stiffer but slower-responding structures, while lighter infills provide higher flexibility and faster vibration response, affecting dynamic behavior under seismic loads.

- 5) Modern alternatives such as autoclaved aerated concrete (AAC) blocks, gypsum boards, and lime-based solid blocks demonstrate a reduction in seismic demand due to their lower self-weight. Among these, AAC blocks notably reduce base shear and time period due to their lightweight nature but exhibit increased lateral displacement, requiring careful consideration in drift control.
- 6) Lime-based solid blocks emerge as a balanced solution-offering moderate stiffness and weight, reduced displacement, and improved energy efficiency-without substantially increasing structural member dimensions.

The overall analysis demonstrates that the lighter infill materials like AAC and gypsum reduce base shear, they may permit excessive lateral deformation. Conversely, denser materials improve lateral stiffness but increase seismic demand. Therefore, in earthquake-prone regions like Nepal, where both seismic safety and cost-efficiency are vital, the infill wall material must be selected based on a balance between displacement control and seismic force minimization. The choice of infill material should be based on holistic assessment that includes seismic safety, displacement control, member sizing, energy efficiency and sustainability.

6. Recommendation for Further Study

While this study provides valuable insights into the influence of various infill materials on seismic behavior of symmetrical RC framed building, but still this is just a preliminary study considering general design procedures. Several areas warrant further exploration to deepen understanding and improve design practices.

- 1) *Experimental Validation*: Future research could include experimental validation of the simulated results through shake table tests or full-scale structural testing. This would help calibrate models and verify behavior under real seismic excitations. The properties of various infill materials can also be verified experimentally.
- 2) *Irregular Buildings*: Further studies could examine how different infill materials perform for buildings with vertically and stiffness irregularities.
- 3) *Seismic Performance Across Varying Intensities*: Further studies could examine how different infill materials perform under varying seismic intensities and soil types.
- 4) *Infill-Frame Interaction and Nonlinear Behavior*: The complex interaction between infill panels and the structural frame, especially under cyclic and post-elastic loading, needs more attention. Future studies should focus on the nonlinear in-plane and out-of-plane behavior of infills, as this interaction can significantly alter the lateral load-resisting mechanism.
- 5) *Fire and Acoustic Performance*: Future studies should assess the fire resistance and sound insulation properties of modern infill materials, especially in high-density urban construction where these parameters are critical.

- 6) *Life Cycle and Environmental Impact Analysis*: Sustainability considerations are increasingly critical in material selection. Future research should perform life cycle assessments (LCA) and cost-benefit analyses of various infill materials, comparing environmental impacts, recyclability, carbon footprint, and long-term cost implications.

Abbreviations

RC	Reinforced Concrete
AAC	Autoclaved Aerated Concrete
FEM	Finite Element Method
URM	Unreinforced Masonry
MRF	Moment Resisting Frame
GF	Ground Floor
IS	Indian Standard

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] C. V. R. Murty, R. Goswami, A. R. Vijayanarayanan and V. V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings" Gujarat State Disaster Management Authority, Government of Gujarat 001_30 May 2013".
- [2] A. A. Costa, A. Penna, and G. Magenes, "Seismic performance of Autoclaved Aerated Concrete (AAC) masonry: From experimental testing of the in-plane capacity of walls to building response simulation," *Journal of Earthquake Engineering*, vol. 15, no. 1, pp. 1-31, Jan. 2011, <https://doi.org/10.1080/13632461003642413>
- [3] P. Halder, S. Bhattacharjya, and S. Chakraborty, "Energy-Based Seismic Performance Assessment of Autoclaved Aerated Concrete Block-Infilled RC Building Structure," 2025, pp. 395-404. https://doi.org/10.1007/978-981-97-6067-1_38
- [4] B. M. Malagimani, S. B. Cholekar, and H. L. Sonawadekar, "Comparative Study of RC Structures with Different Types of Infill Walls with Effect of SSI by Pushover Analysis," *International Research Journal of Engineering and Technology*, 2017, [Online]. Available: www.irjet.net
- [5] H. Varum, R. Dumar, A. Furtado, A. R. Barbosa, D. Gautam, and H. Rodrigues, "Seismic performance of buildings in Nepal after the Gorkha earthquake," in *Impacts and Insights of the Gorkha Earthquake*, Elsevier, 2018, pp. 47-63. <https://doi.org/10.1016/B978-0-12-812808-4.00003-1>
- [6] A. Wijeyewickrema, N. Subedi, and A. C. Wijeyewickrema, "Performance of RC Buildings with Masonry Infill Walls during the 2015 Gorkha, Nepal Earthquake." [Online]. Available: <https://www.researchgate.net/publication/329887272>

- [7] G. Zewdie Tsige, "Seismic Performance of Reinforced Concrete Buildings with Masonry Infill," *American Journal of Civil Engineering*, vol. 6, no. 1, p. 24, 2018, <https://doi.org/10.11648/j.ajce.20180601.15>
- [8] "FEMA 356 Prestandard and Commentary for the Seismic Rehabilitation of Buildings," 2000.
- [9] I. Standard, "la jpukvks a os Q Hkw dEijks /h fMtkbu os Q ekuna M Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings (Sixth Revision) Hkkjrh; ekud," 2016. [Online]. Available: www.standardsbis.in
- [10] Bureau of Indian Standards, "IS 875-1 (1987): Code of Practice For Design Loads (Other Than Earthquake) For Buildings And Structures, Part 1: Dead Loads - Unit Weights of Building Material And Stored Materials (Incorporating IS 1911 : 1967)."
- [11] B. of Indian Standards, "IS 875 (Part 2): Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures. Part 2: Imposed Loads (Second Revision)," 1989.
- [12] B. Panthi, P. Dahal, P. Shrestha, and K. B. Thapa, "Fundamental period of RC buildings with infill walls in Nepal," *Asian Journal of Civil Engineering*, vol. 22, no. 5, pp. 983-993, Jul. 2021, <https://doi.org/10.1007/s42107-021-00359-y>