



# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 5, May 2025**

# Comparative Analysis of Multi-Storey Tall Structure by using Different Types of Filler System

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**ABSTRACT:** Reinforcement concrete buildings with masonry enemies are most often built in India. Traditionally, traditional clay stones or concrete blocks, which are heavy rigid materials, have been used as flood walls. AAC (lightweight concrete) blocks. It is a lightweight, flexible building material that provides insulation and fire resistance, has low environmental impact, and can be used as a masonry filling in buildings. The AAC block is now available in India. Many researchers have investigated the behavior of experimentally filled reinforced concrete (R/C) frames. Interacting. Bricks are also introduced, which has an advantage over AAC bricks. Therefore, this report presents a comparative test of the effect of the type of filling wall material on wind response. Traditional layers of material with AAC blocks interlock blocks, and clay bricks are used for comparison. Analyses were performed using the facility to check the operation of the RC frame with interlock blocks, AAC blocks and traditional clay bricks. Three models are considered for comparison. One is trained in traditional bricks, the second is equipped with AAC blocks, and the third is a filling frame with an open floor. Analytically model the infill using comparable oblique strut methods. The edge of the diagonal strut is ping elk. The infill acts like a compression strut between the column and the beam, with the compressive force being transmitted from one knot to another. Analysis was performed due to live load (LL) and wind load of dead (DL). The results show that AAC-Block-Infill and interlocking materials behave better under lateral stress than traditional bricks.

**KEYWORDS:** AAC-Block-Infill, Infill, Concrete, Wind, Bricks, reinforced concrete (R/C) frames

## I. INTRODUCTION

Reinforced concrete buildings with masonry filling are the most common type of construction in India. Masonry walls are generally considered non-structural elements as they are provided for functional and architectural visual functions. Therefore, infill interactions are ignored in the binding frame of the design. The infill panel interacts with the coupling frame and induces a load resistance mechanism when exposed to lateral loads. The effects of infills are ignored in modeling the RC structure and lead to inaccuracy inference to infer the actual seismic behavior of framed structures. Filling walls of filling frames are from traditional sound, bricks, concrete blocks, or AAC blocks. Investigations of the effects of infill materials on seismic reactions in batch frames are still limited. AAC blocks, interlock blocks, and clay stones are used as infills for RC frames. AAC blocks provide insulation and fire materials and are light building materials with low environmental impact. The conclusion will be drawn from you. This has a significant impact on materials that significantly affect the lateral response of the filled framework. Filling material Improved performance of the RC frame structure. The infill wall reduces lateral bending, strong drift and bending moments within the frame, increasing the likelihood of collapse of the column axial force. Considering infill leads, lean frame design members are developed to reduce the total cost of the structural system. Therefore, structural frames ensure warehousing functionality, while filling walls help separate the inside and outer space and fill boxes of the outer frame. Filled walls have their own static function of carrying their own weight. Infill. The wall is an external vertical closure type closure. As for other categories of walls, the infill wall is different from two interiors, partitions that separate the walls of the non-lattice warehouse and support walls. The latter satisfies the same functions of infill walls, hygiene and acoustics, but also static functions. The use of fine masonry walls and to some degree of use of benil walls, particularly in reinforced concrete frame structures, is common in many countries. In fact, the use of fine masonry walls provides an economic and lasting solution. It's easy to build, attractive for the architecture, and has a very efficient cost.



Today, masonry and partitions are primarily composed of sound units, but aggregated concrete units (poets and light units) are also used. Recently, the industry has also been trying to try wooden blocks. Separating walls are produced in both vertical and horizontal perforations, and sound blocks represent two-thirds of the corresponding market. Benefits of fine masonry blocks. Masonry is prone to burning, improving fire protection for buildings and residents. Fireplaces are often made up of masonry for the same reason. Masonry provides high resistance to natural disasters such as rot, pests, weather, and hurricanes and tornadoes. It can withstand large amounts of pressure-weight loads.

Masonry units increase the thermal mass of a building. Masonry units increase the thermal mass of a building. Ants and termites cannot destroy their structure. AAC products are made up of quartz sand, calculated gypsum, lime, cement, water and aluminium powder. Invented in the mid-1920s AAC At the same time, it provides structure, insulation, and fire and mould. The foam includes blocks, wall panels, floor and roof plates, fan (façade) panels and waterfalls. In addition to fast and simple installation, AAC materials can be sanded or sanded to size with standard electrical tools with carbon steel cutters. Benefits of AAC Blocks Recycled Industrial Waste (Flight Ash), Non-toxic Ingredients, Edition. No Gas, and Less Energy Testing makes ACC Blocks environmentally friendly and sustainable. This allows for the construction of larger buildings. The absorption quality is excellent. Provides sound absorption of approximately 42 dB and blocks all critical noise and obstacles that are ideal for schools, hospitals, hotels, offices, apartment buildings, and other structures that require acoustic insulation.

Mixed bricks are produced by mixing sand, soil and cement. This mixture is machine-compressed to create interlocking patterns of bricks, which are soothed for seven days. Interior blocks usually offer reduced cost savings compared to regular brick production. On the other side of the brick is depression, which aims to maintain the projection of the brick on the other side. In fact, linking bricks can be up to 35% cheaper than regular bricks. Intectent bricks are outsourpos with a mixture of sand and soil and contain only 10% cement. Intecting bricks have their own support system that does not support itself on mortar, but supports each other. The interlocking bricks are compressed, with more mass, and the bricks retain the interior of the structure

## II. LITERATURE SURVEY

**Ashish Patil and Dr. Ajay G. Dhake (2021)** examined the layout concept of connected structure blocks and their applications as walls of their applications. On the wall, its strength properties have been tested using ANSYS software. Similarly, using each link will not increase electricity, but minimizes the amount of human effort. Such blocks can be transferred from location to another block without any problems. Concrete degree M50 was used for blocking instructions in software applications. Compared to triggered concrete walls, the load on the prefabricated walls of FERA is significantly lower than that of the RCC wall. Simplified construction cycles reduce time, increase productivity, reliability, efficiency, and reduce costs. FEVACK Construction work offers extended service life and reduced maintenance costs. FebaufConcrete is dense against chemical attacks, erosion, impact, soil suction, and dust.

**Irfan Khan et.al (2021)** Analysis results were compared to experimental test results for unenhanced exposed to lateral stress along with constant axial loading. Abaqus was used to model and analyse finite element walls. Various material properties are defined for the software walls and are modeled as uniform materials. The damage patterns of monotonous lateral shifts in experimental and numerical models are closely tuned to demonstrate the reliability of the finite element package. The monotony response of multistorey DSMs can be predicted based on the results of ABAQUS software. However, the hysteresis loop pattern obtained from Abaqus does not match the experimental diagram, but it can predict the cyclic behavior of DSM.

**Manoj U. Deosarkar et.al (2021)** Plastic tribes respond to corresponding experimental oblique cracks due to periodic stress. Big horizontal and vertical, and to prevent you from slipping. Blocks are efficient to resist gliding horizontally and vertically. The grooves and keys are strong enough to resist the shell and degrade due to mild effects. Earthquake performance at the rehearsal PS and DS levels was much higher than that of the rehearsal CB. In particular, the deformability of the proposed system was greatly improved by the interlocking mechanism between the main block and the key block. The calculated lateral loads based on simple swings were in good agreement with the experimental results. The energy skating ability of the proposed system was the ability of the test CB. The

proposed seismic block system can be reused at more than 70% after final load. This result means that the proposed concrete block wall system is economical and environmentally friendly. algorithm.

### III. METHODOLOGY

This section outlines the methodology employed to compare three types of infill materials—masonry, AAC blocks, and interlocking blocks—within a G+14 storey structure subjected to similar loading scenarios.

This segment traces the technique utilized to compare three sorts of infill materials like masonry, AAC pieces, and interlocking blocks within a G+14 story structure subjected to comparative stacking scenarios. Modelling and Investigation

Procedure:

Step 1: A comprehensive audit of existing writing was conducted at the projects initiation to get it earlier thinks about on seismic and wind behavior of structures utilizing different infill systems.

Step 2: ETABS program was utilized for modelling. A G+14 story structure was made utilizing the fast format highlight, with a uniform story stature of 3 meters, counting the ground floor.

Step 3: The auxiliary outline was modeled in both X and Y headings, with the Z-axis speaking to the vertical tallness. A lattice dispersing of 5 meters was kept up along the X and Y axes.

Step 4: Properties were characterized for all basic components, counting concrete, steel, chunks, and infill materials. Particularly, M30 review concrete and HYSD 415 review support were used.

Step 5: Cross-sectional properties for pillars, columns, pieces, and infill dividers were indicated within the model.

Step 6: Settled bolsters were connected at the base of the structure to supply restriction within the X, Y, and Z directions.

Step 7: Stack designs and combinations were built up, and wind loads were connected concurring to IS 875:2015 standards.

Step 8: The demonstrate was analysed for key auxiliary reactions, counting relocation, shear drive, twisting minute, hub constrain, and base shear.

Step 9: At last, the comes about were organized into tables, and a comparative assessment was carried out over the three infill sorts beneath indistinguishable stacking conditions.

### IV. EXPERIMENTAL DATA

Within the display ponder, ETABS Program is utilized for Wind Examination of structure. The three infill's are demonstrated and planned utilizing ETABS. Measurement of building is 13.62 m 16.30 m. Each floor tallness is 3m. Soil layer f 3m profundity is additionally considered in this think about. Material utilized for examination is Fe 415 steel and M30 review of concrete. Thickness of the slab is 200 mm.

**Table 4.1 Geometrical Properties**

**Table 4.2 Material Properties**

| Geometrical Properties     |               | Properties of Concrete           |                           |
|----------------------------|---------------|----------------------------------|---------------------------|
| Type of Structure          | G+14          | Material Name                    | M30                       |
| Plan dimensions            | 13.62m×16.30m | Direction Symmetrical Type       | Isotropic                 |
| Height of each storey      | 3m            | Material weight per Unit volume  | 24.9926kN/m <sup>3</sup>  |
| Foundation Level to ground | 3m            | Mass per unit Volume             | 2548.538kg/m <sup>3</sup> |
| Size of beams              | 400x200mm     | Modulus of Elasticity, E         | 27386.13MPa               |
| Size of Column             | 400x400mm     | Poisson's Ratio                  | 0.2                       |
| thickness of slab          | 200mm         | Coefficient of Thermal Expansion | 0.00000551/C              |
| AAC wall Thickness         | 200mm         | Shear Modulus, G                 | 11410.89MPa               |
| Masonry wall thickness     | 200mm         |                                  |                           |

|                             |       |
|-----------------------------|-------|
| Interlocking Wall Thickness | 200mm |
|-----------------------------|-------|

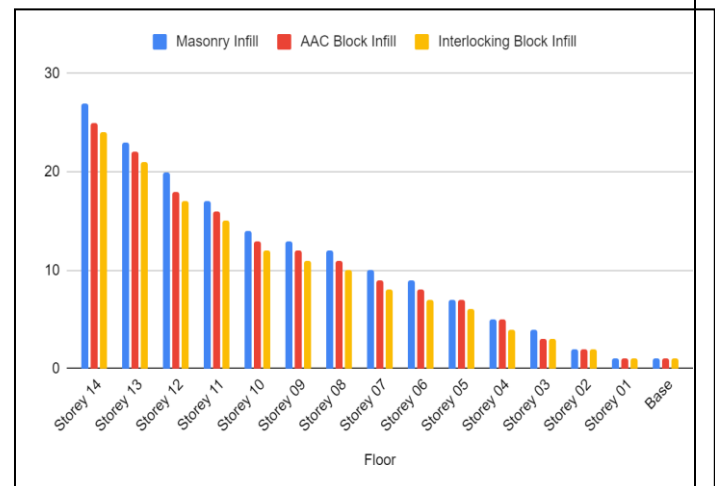
| Properties of AAC Block          |                           | Properties of Rebar              |                           |
|----------------------------------|---------------------------|----------------------------------|---------------------------|
| Material Name                    | AAC Block                 | Material Name                    | HYSD415                   |
| Direction Symmetrical Type       | Isotropic                 | Direction Symmetrical Type       | Uniaxial                  |
| Material weight per Unit volume  | 21.2068kN/m <sup>3</sup>  | Material weight per Unit volume  | 76.9726kN/m <sup>3</sup>  |
| Mass per unit Volume             | 2548.538kg/m <sup>3</sup> | Mass per unit Volume             | 7849.047kg/m <sup>3</sup> |
| Modulus of Elasticity, E         | 3600000MPa                | Modulus of Elasticity, E         | 200000MPa                 |
| Poisson's Ratio                  | 0.2                       | Coefficient of Thermal Expansion | 0.00001171/C              |
| Coefficient of Thermal Expansion | 0.00000811/C              |                                  |                           |
| Shear Modulus, G                 | 1500000MPa                |                                  |                           |
| Thickness                        | 200mm                     |                                  |                           |

## V. EXPERIMENTAL RESULTS

### 1. Storey Displacement:-

**Table 5.1 Storey Displacement in mm**

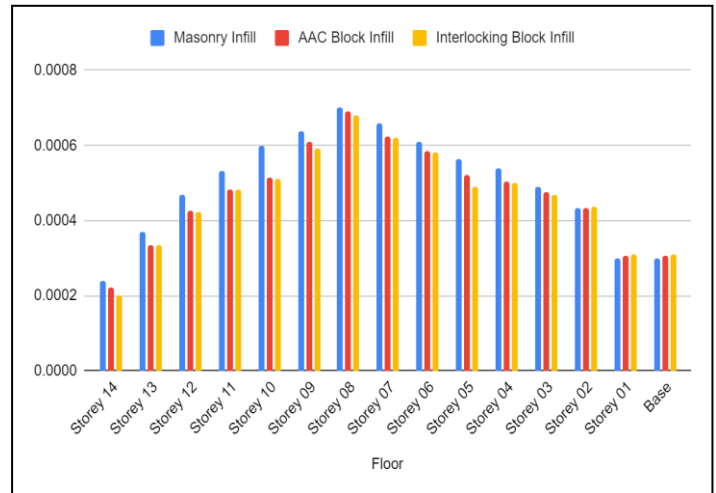
| Storey displacement in mm |                |                  |                           |
|---------------------------|----------------|------------------|---------------------------|
| Floor                     | Masonry Infill | AAC Block Infill | Interlocking Block Infill |
| Storey 14                 | 27             | 25               | 24                        |
| Storey 13                 | 23             | 22               | 21                        |
| Storey 12                 | 20             | 18               | 17                        |
| Storey 11                 | 17             | 16               | 15                        |
| Storey 10                 | 14             | 13               | 12                        |
| Storey 09                 | 13             | 12               | 11                        |
| Storey 08                 | 12             | 11               | 10                        |
| Storey 07                 | 10             | 9                | 8                         |
| Storey 06                 | 9              | 8                | 7                         |
| Storey 05                 | 7              | 7                | 6                         |
| Storey 04                 | 5              | 5                | 4                         |
| Storey 03                 | 4              | 3                | 3                         |
| Storey 02                 | 2              | 2                | 2                         |
| Storey 01                 | 1              | 1                | 1                         |
| Base                      | 1              | 1                | 1                         |



### 2. Storey Drift:-

**Table 5.2 Storey drift in mm**

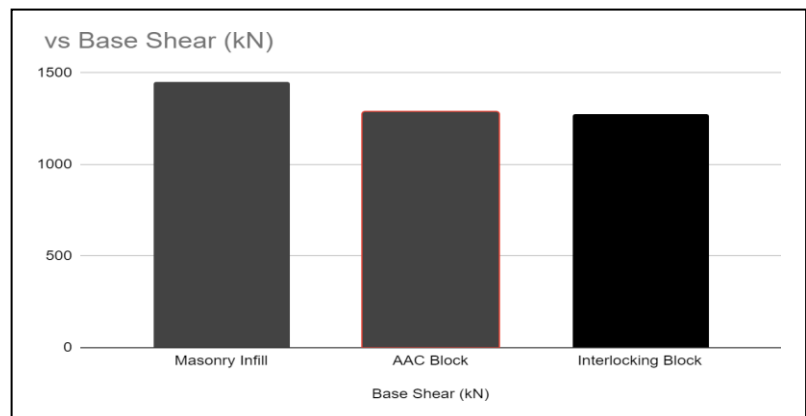
| Storey drift in mm |                |                  |                           |
|--------------------|----------------|------------------|---------------------------|
| Floor              | Masonry Infill | AAC Block Infill | Interlocking Block Infill |
| Storey14           | 0.000239       | 0.00022          | 0.0002                    |
| Storey13           | 0.000369       | 0.00034          | 0.00033                   |
| Storey12           | 0.00047        | 0.00043          | 0.00042                   |
| Storey11           | 0.000533       | 0.00048          | 0.00048                   |
| Storey10           | 0.000599       | 0.00051          | 0.00051                   |
| Storey09           | 0.000639       | 0.00061          | 0.00059                   |
| Storey08           | 0.000701       | 0.00069          | 0.00068                   |
| Storey07           | 0.000659       | 0.00062          | 0.00062                   |
| Storey06           | 0.00061        | 0.00058          | 0.00058                   |
| Storey05           | 0.000563       | 0.00052          | 0.00049                   |
| Storey04           | 0.000538       | 0.00051          | 0.0005                    |
| Storey03           | 0.000491       | 0.00047          | 0.00047                   |
| Storey02           | 0.000432       | 0.00043          | 0.00044                   |
| Storey01           | 0.0003         | 0.00031          | 0.00031                   |
| Base               | 0.0003         | 0.00031          | 0.00031                   |



### 3. Base Shear:-

**Table 5.3 Base Shear in mm**

| Base Shear (kN)    |          |
|--------------------|----------|
| Masonry Infill     | 1453.009 |
| AAC Block          | 1285.75  |
| Interlocking Block | 1272.87  |



## VI. CONCLUSION

Structure with infill wall built using interlocking block has lowest value of stress when compared with other two models. The different configuration of infill panel gives different amount of base shear. the different configuration of infill in elevation influences the seismic performance of building. The results show that the interlocking hollow block wall system displacement subjected to earthquake is within acceptable range.

### Storey Displacement

The lateral displacement of the story in relation to the base is known as story displacement. The building's severe lateral displacement can be limited by the lateral force-resisting system. For a wind load situation, the acceptability lateral displacement limit might be  $H/500$  (others may choose  $H/400$ ). In comparison to structures with AAC block infill and structures with interlocking Block Infill, the largest Storey Displacement was found at the top storey for structures with masonry infill.

### Storey Drift

In general, one would subtract the narrative displacement of level "X" from the story displacement of level "X-1" to determine the story drift of level "X." For example, level 4's storey drift is equal to level 4's total story displacement minus level 3's story displacement. The storey drift in any storey due to the minimum required design lateral force, with a partial load factor of 1.0, shall not exceed 0.004 times the storey height, according to IS 1893 (part 1): 2002 Cl. 7.11.3. In comparison to structures with AAC Block and structures with Interlocking Block, storey drift was greatest at Storey 8 in structures with masonry infill.

### Base Shear

The most extreme anticipated sidelong stretch on the base of the structure owing to seismic action is called base shear. It's evaluated utilizing the seismic zone, soil fabric, and horizontal constrain formulae from the building code.  $V = 0.2$  is the fundamental shear equation (W) V indicates the shear constrain that will be made at a building's base. The number 0.2 indicates the size of an seismic tremor. The building's weight is indicated by the letter W. The base shear for a structure with brick work infill was 1453.009 kN, whereas the base shear for a structure with AAC Piece infill and a structure with interlocking square infill was 1285.75 kN and 1272.87 kN, separately.

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