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# Seismic Analysis and Comparative Study of Brick Wall, Shear Wall and Bare Frame on G+12 High Rise Building

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***Abstract: Today, larger part of designs around us are built up concrete cement (RCC) outlined constructions. To forestall harm because of quake there is a need to foster powerful procedure to expand the strength and flexibility of elevated structures. Shear wall are steadier and more pliable and thus can bear more even loads. In this paper, we have proposed a relative report between block facade, shear divider and uncovered casing by using ETABS programming. This review is essentially centered around seismic conduct of G+12 building. The outcomes are talked about as far as base shear, sidelong relocation, story float, story solidness and normal period for every one of the three models. We find that shear wall has least parallel uprooting and least time span when contrasted and block facade and uncovered edge. Likewise, we track down that the shear divider model is more adaptable because of lesser float when contrasted and different models. The upsides of removal and float for shear wall is likewise not as much as block facade since the tallness of the structure increments.***
***Keywords: shear wall, bare frame, Response spectrum, Earthquake, ETABS***

## I. INTRODUCTION

Shear Walls are upward plate type built up concrete (RC)components notwithstanding sections, bars and segments in the construction. These walls by and large beginning from the establishment and stretch out as far as possible up to the structure's tallness. They can be just about as dainty as 150mm and as thick as 400mm in tall structure structures. Shear wall are ordinarily developed all through their length and width of a construction.

Shear wall can be considered as sections of enormous width and profundity, which communicate tremor burdens to the establishment. Shear wall enormously increment the strength and solidness of the structure, toward the path they're developed, which thus lessens the sidelong influence and, subsequently, distortion of the structure and harm to its substance is decreased. The cross-segment of shear wall is rectangular, which infers one measurement is a lot bigger than the other. L-and U-plan cross-areas are well known, while rectangular cross-segments are the most common. Structures with flimsy walled RC shafts work as shear wall around the lift center are utilized to forestall seismic impact. The limited brick work structure shows an unbending conduct. The shear obstruction of the jacketed wall was fundamentally further developed when the unreinforced block brick work wall were reinforced. Material supported cement (TRC) fortifications have lower sidelong strength ability than fiber-built up polymer (FRP) fortifications, yet they have considerably higher pliability.

Standard wooden pillars and block stone work implodes rapidly during unexpected seismic tremors, since inversion of stresses happens. When contrasted with the shear divider thought of box-like three-dimensional structures, RCC outlined designs are limited. Not exclusively are the proposed shear divider developments steadier, yet additionally more bendable, in correlation with RC outlined constructions.

As far as wellbeing, it suggests that, they won't fall unexpectedly, and consequently forestall the death toll during serious tremors. They give adequate alerts, like expanding primary crevices, yielding poles, and different pointers, permitting individuals to clear designs, before they breakdown totally.

Outside wall are viewed as shear-opposing wall for substantial support. Powers from the roof and rooftop stomachs is moved to the shear wall, which thus moves it through establishment by means of suitable burden ways.

## II. MODELLING

ETABS programming is utilized to reproduce a G+12 story working with each base story tallness of 3m and a common story stature of 3m. The constructions of structures should be attached at the ground. Three unique models were thought of, out of which one is brickwork model, second is shear divider and the third is uncovered frame.12 modes were considered for each model.

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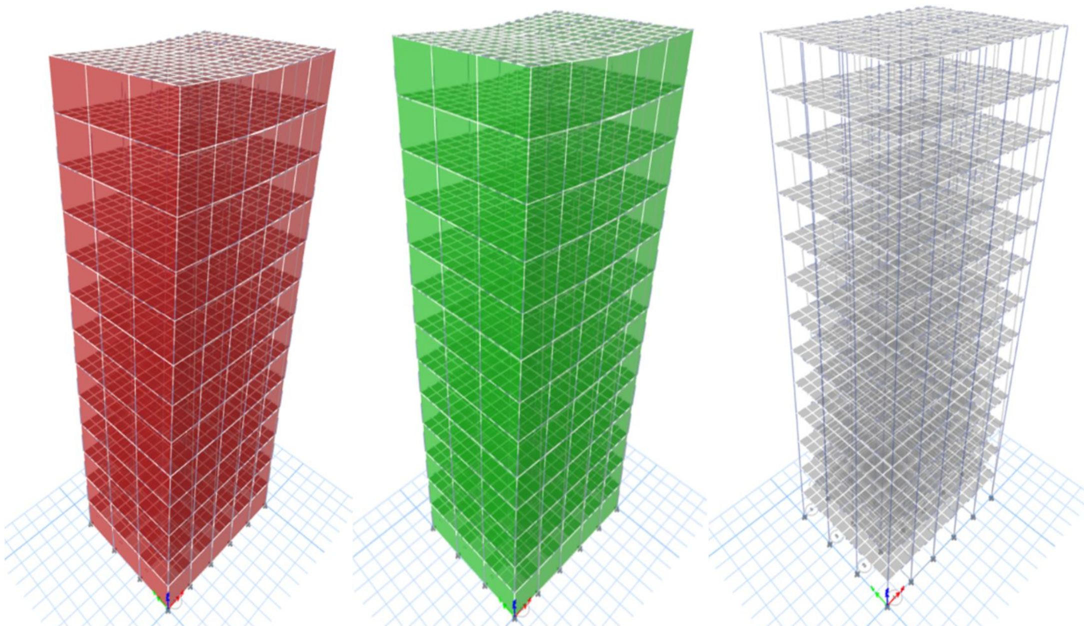


Fig. 1(a) Fig. 1(b) Fig. 1(c)

Fig.1. Deformed shape of (a) Brick wall (b) shear wall and (c) bare frame of G+12 multi-storey building

| **Plan Size** | **15m X 12m** |
|---|---|
| No. Of Storeys | 13 |
| Bottom Storey Height | 3m |
| Typical storey height | 3m |
| Thickness Of Slab | 0.15m |
| Wall Thickness | 0.23m |
| Column Size | 0.5m X 0.5m |
| Beam Size | 0.3m X 0.5m |
| Grade of steel | Fe500 |
| Grade of concrete for beam | M25 |
| Grade of concrete for column | M25 |
| Floor finish | $1kN/m^2$ |
| Live load on floor | $4kN/m^2$ |
| Live load on roof | $1kN/m^2$ |
| Zone Factor | 0.16 |

Table 1. Geometric details of G+12 structure building

| | |
|---|---|
| Response Reduction Factor | 5 |
| Importance Factor | 1 |
| Soil Condition | Medium |
| Type | II |
| Zone | III |

Table 2. Seismic details of building

## III. METHODOLOGY

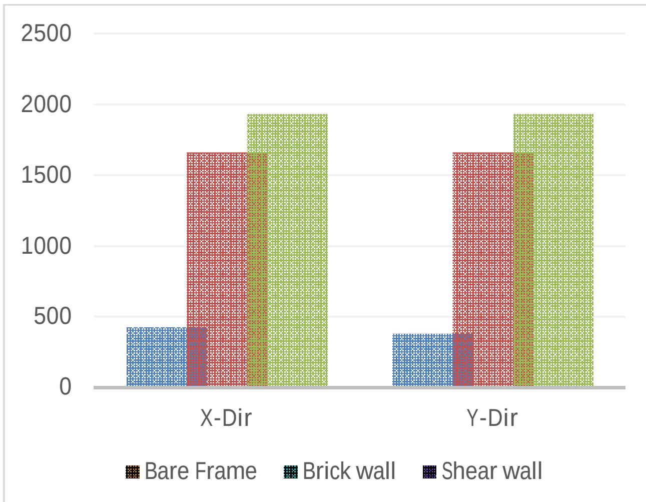
*A.* For this study, ETABS software is used to simulate a G+12 storey building with each bottom storey height of 3m and a typical storey height of 3m.

*B.* The structures are supposed to be permanently affixed to the ground. Three different models were considered: the brickwork model, the shear wall model, and the bare frame model.

*C.* In zone III, all models are compared for lateral displacement, storey drift, storey stiffness, base shear, and natural period

## IV. RESULT AND DISCUSSION

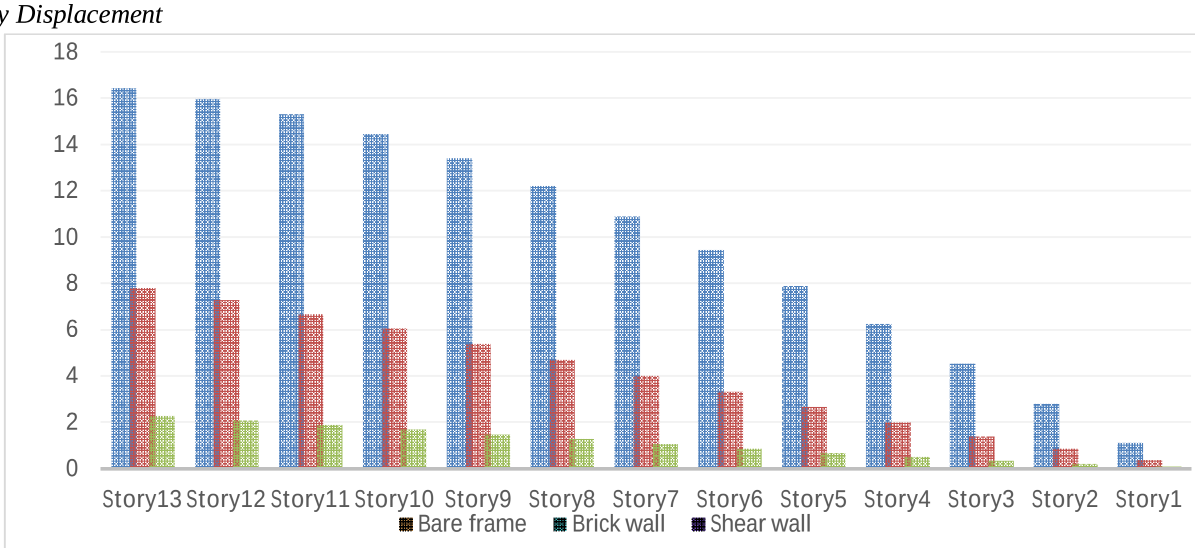
### *A. Base Shear*




Comparison of base shear of bare frame, brick wall and shear wall

| | X-DIR KN | Y-DIR KN |
|---|---|---|
| BARE FRAME | 424.9284 | 382.4537 |
| BRICK WALL | 1661.3748 | 1661.3748 |
| SHEAR WALL | 1934.2787 | 1934.2787 |

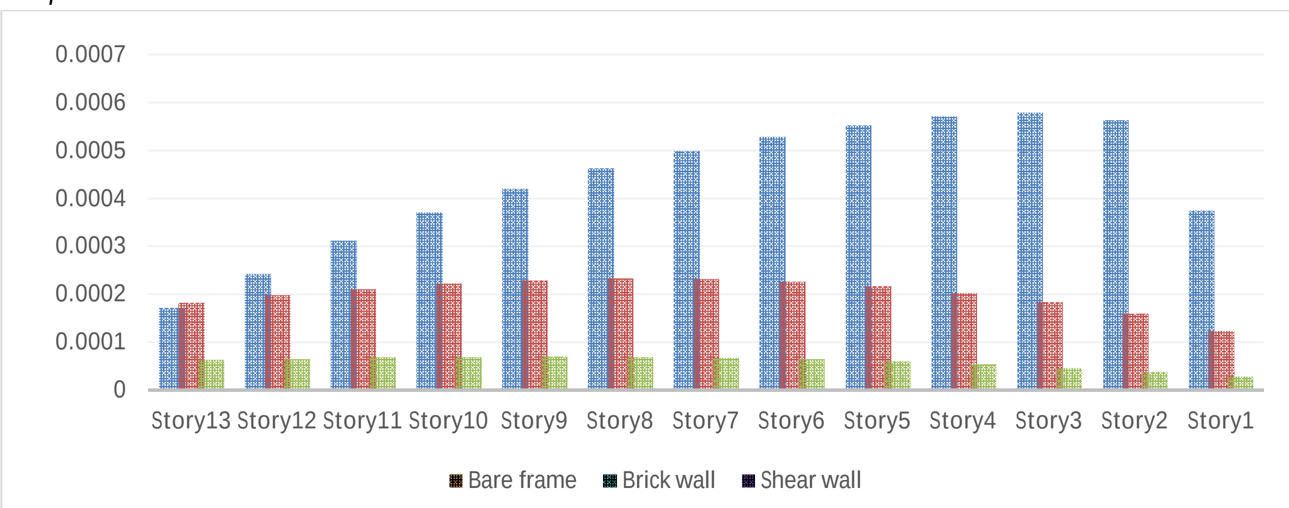
### *B. Storey Displacement*




Comparison of storey displacement of Bare frame, Brick wall and Shear wall

| Story | BARE FRAME mm | BRICK WALL mm | SHEAR WALL mm |
|---|---|---|---|
| Story13 | 16.45 | 7.803 | 2.267 |
| Story12 | 15.971 | 7.259 | 2.08 |
| Story11 | 15.301 | 6.671 | 1.885 |
| Story10 | 14.441 | 6.043 | 1.684 |
| Story9 | 13.407 | 5.384 | 1.478 |
| Story8 | 12.217 | 4.703 | 1.27 |
| Story7 | 10.89 | 4.013 | 1.064 |
| Story6 | 9.442 | 3.324 | 0.864 |
| Story5 | 7.89 | 2.65 | 0.673 |
| Story4 | 6.252 | 2.003 | 0.495 |
| Story3 | 4.549 | 1.399 | 0.335 |
| Story2 | 2.81 | 0.851 | 0.197 |
| Story1 | 1.125 | 0.373 | 0.085 |

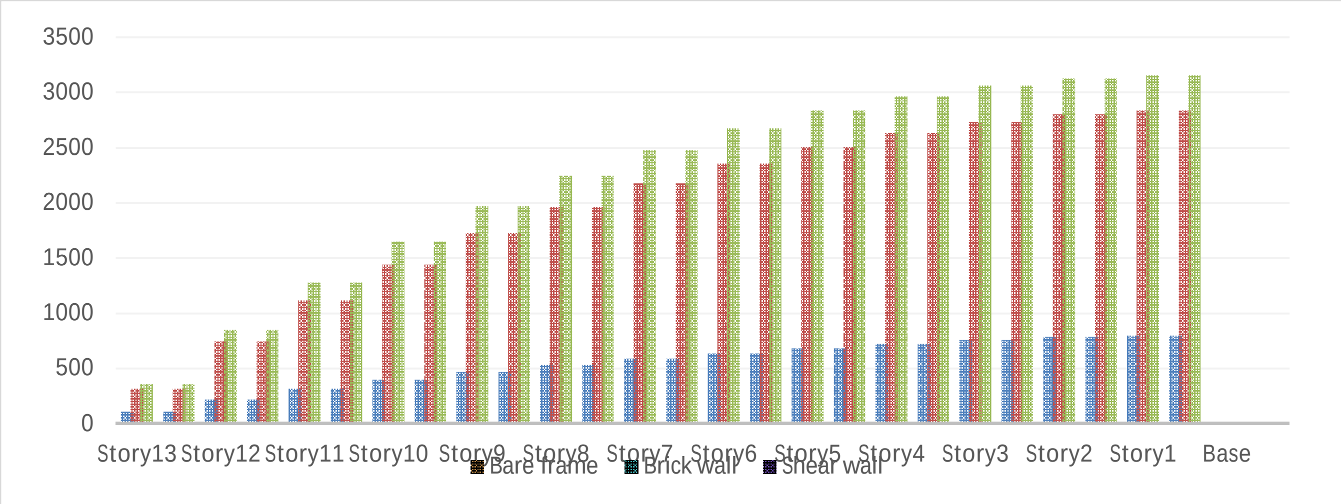
### *C. Storey Drift*




Comparison of storey drift between brick wall, shear wall and bare frame

| Story | BARE FRAME | BRICK WALL | SHEAR WALL |
|---|---|---|---|
| Story13 | 0.000171 | 0.000182 | 0.000063 |
| Story12 | 0.000243 | 0.000198 | 0.000065 |
| Story11 | 0.000312 | 0.000211 | 0.000068 |
| Story10 | 0.000371 | 0.000222 | 0.000069 |
| Story9 | 0.000421 | 0.000229 | 0.00007 |
| Story8 | 0.000463 | 0.000233 | 0.000069 |
| Story7 | 0.000499 | 0.000232 | 0.000067 |
| Story6 | 0.000529 | 0.000227 | 0.000064 |
| Story5 | 0.000553 | 0.000217 | 0.00006 |
| Story4 | 0.000571 | 0.000202 | 0.000054 |
| Story3 | 0.00058 | 0.000183 | 0.000046 |
| Story2 | 0.000563 | 0.000159 | 0.000038 |
| Story1 | 0.000375 | 0.000124 | 0.000028 |

### D. *Storey Shear*




Comparison of storey shear for Brick wall, Shear wall and Bare frame

| | | BARE FRAME | BRICK WALL | SHEAR WALL |
|---|---|---|---|---|
| | | kN | kN | kN |
| Story13 | Top | 107.6414 | 317.6548 | 356.1047 |
| | Bottom | 107.6414 | 317.6548 | 356.1047 |
| Story12 | Top | 219.8743 | 744.3388 | 848.8906 |
| | Bottom | 219.8743 | 744.3388 | 848.8906 |
| Story11 | Top | 315.5285 | 1118.0874 | 1279.7137 |
| | Bottom | 315.5285 | 1118.0874 | 1279.7137 |
| Story10 | Top | 397.3073 | 1442.0232 | 1652.3149 |
| | Bottom | 397.3073 | 1442.0232 | 1652.3149 |
| Story9 | Top | 468.5626 | 1722.2068 | 1972.634 |
| | Bottom | 468.5626 | 1722.2068 | 1972.634 |
| Story8 | Top | 530.9933 | 1964.4126 | 2246.5059 |
| | Bottom | 530.9933 | 1964.4126 | 2246.5059 |
| Story7 | Top | 586.5147 | 2173.7585 | 2479.3282 |
| | Bottom | 586.5147 | 2173.7585 | 2479.3282 |
| Story6 | Top | 637.216 | 2354.3435 | 2675.5691 |
| | Bottom | 637.216 | 2354.3435 | 2675.5691 |
| Story5 | Top | 683.4343 | 2508.1459 | 2837.8122 |
| | Bottom | 683.4343 | 2508.1459 | 2837.8122 |
| Story4 | Top | 724.3491 | 2635.1116 | 2966.9274 |
| | Bottom | 724.3491 | 2635.1116 | 2966.9274 |
| Story3 | Top | 759.0642 | 2733.9502 | 3063.0148 |
| | Bottom | 759.0642 | 2733.9502 | 3063.0148 |
| Story2 | Top | 784.7432 | 2801.8886 | 3125.6982 |
| | Bottom | 784.7432 | 2801.8886 | 3125.6982 |
| Story1 | Top | 796.5422 | 2835.1476 | 3154.8989 |
| | Bottom | 796.5422 | 2835.1476 | 3154.8989 |
| Base | Top | 0 | 0 | 0 |
| | Bottom | 0 | 0 | 0 |

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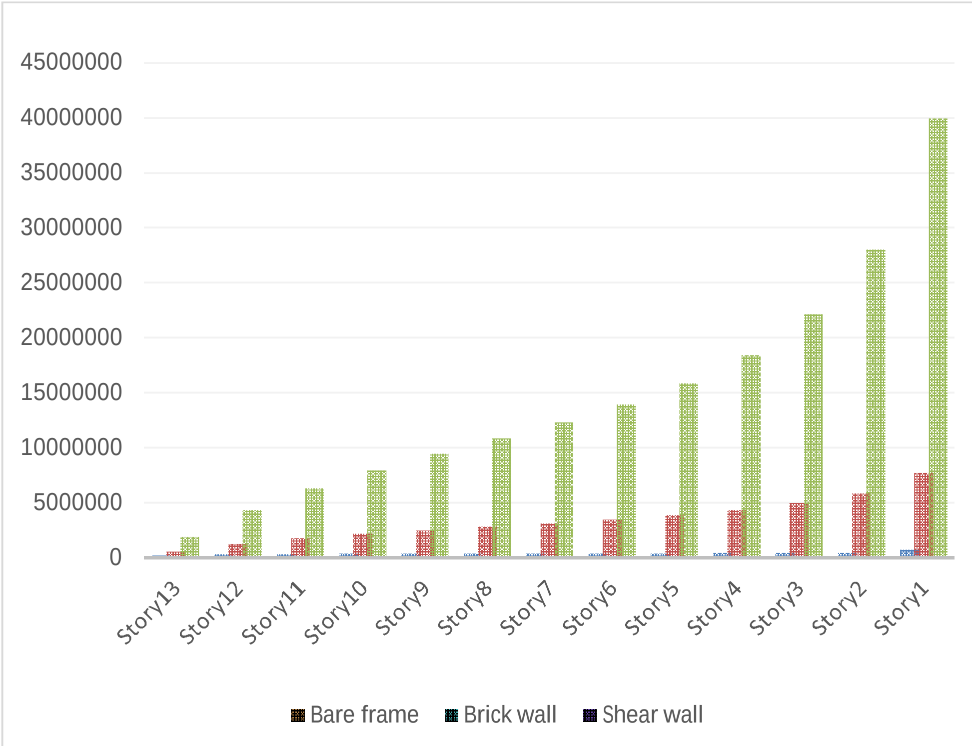
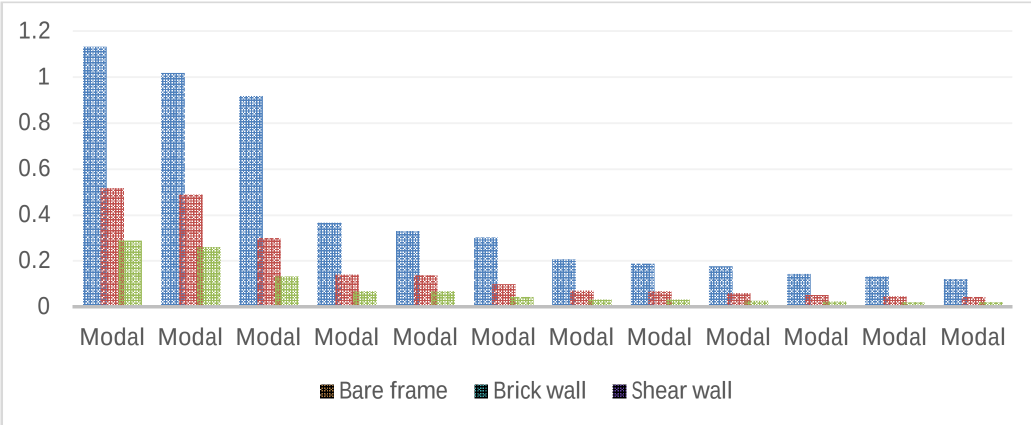
*E. Storey Stiffness*




Storey stiffness [kN/m] for shear wall, brick wall and bare fr

| Story | BARE FRAME | BRICK WALL | SHEAR WALL |
|---|---|---|---|
| Story13 | 211139.25 | 582272.385 | 1908837.401 |
| Story12 | 302105.488 | 1256480.02 | 4346256.551 |
| Story11 | 337599.296 | 1763412.183 | 6318142.555 |
| Story10 | 357207.516 | 2163906.358 | 7970325.979 |
| Story9 | 370939.516 | 2503417.899 | 9438041.936 |
| Story8 | 381953.355 | 2815870.647 | 10839312.678 |
| Story7 | 391860.868 | 3128556.115 | 12288072.227 |
| Story6 | 401728.003 | 3467107.193 | 13911932.089 |
| Story5 | 411892.798 | 3859137.889 | 15876667.971 |
| Story4 | 422641.449 | 4341832.754 | 18443070.628 |
| Story3 | 435891.519 | 4977396.904 | 22116302.899 |
| Story2 | 465094.857 | 5876694.845 | 27997576.711 |
| Story1 | 709202.442 | 7708986.112 | 39968844.993 |

*F. Time Period*




Time period of brick wall, shear wall and bare frame

| Case | Mode | BARE FRAME | BRICK WALL | SHEAR WALL |
|---|---|---|---|---|
| Modal | 1 | 1.132 | 0.518 | 0.29 |
| Modal | 2 | 1.019 | 0.489 | 0.26 |
| Modal | 3 | 0.919 | 0.299 | 0.132 |
| Modal | 4 | 0.368 | 0.141 | 0.068 |
| Modal | 5 | 0.332 | 0.139 | 0.068 |
| Modal | 6 | 0.303 | 0.1 | 0.044 |
| Modal | 7 | 0.208 | 0.073 | 0.034 |
| Modal | 8 | 0.189 | 0.07 | 0.033 |
| Modal | 9 | 0.178 | 0.06 | 0.027 |
| Modal | 10 | 0.144 | 0.051 | 0.024 |
| Modal | 11 | 0.132 | 0.048 | 0.023 |
| Modal | 12 | 0.123 | 0.043 | 0.022 |

## V. CONCLUSION

The following conclusion may be reached from the research work's examination of three models of bare frame, brick wall, and shear wall, taking into account various characteristics such as time period of oscillation, lateral displacement, stiffness, storey shear, and storey drift.

*1)* The model with Shear wall has the least time period than other models and model of bare frame has maximum time period. Hence, if we consider time period as the only factor then the model with shear wall will be the best choice.
*2)* The model with bare frame has more lateral displacement under the application of lateral force than brick wall, and shear wall has the least displacement, so we can say that if the structure has to be made greater seismic resistance, then shear wall would be the best choice.
*3)* The model of bare frame has the least stiffness while the model of shear wall has maximum stiffness, so when we consider the stiffness criteria, we tend to choose the model having the least stiffness in order to provide flexibility to the building model so that the building does not develop cracks in the event of an Earthquake.
*4)* The model with Shear wall has minimum drift and hence it is more efficient and more flexible when compared with other models.
*5)* Shear wall is more effective in reducing displacements and drifts, than brick wall
*6)* As height of the building increase, displacement and drift also increase, but for shear wall models displacement and drifts value is significantly lower than of brick walls.

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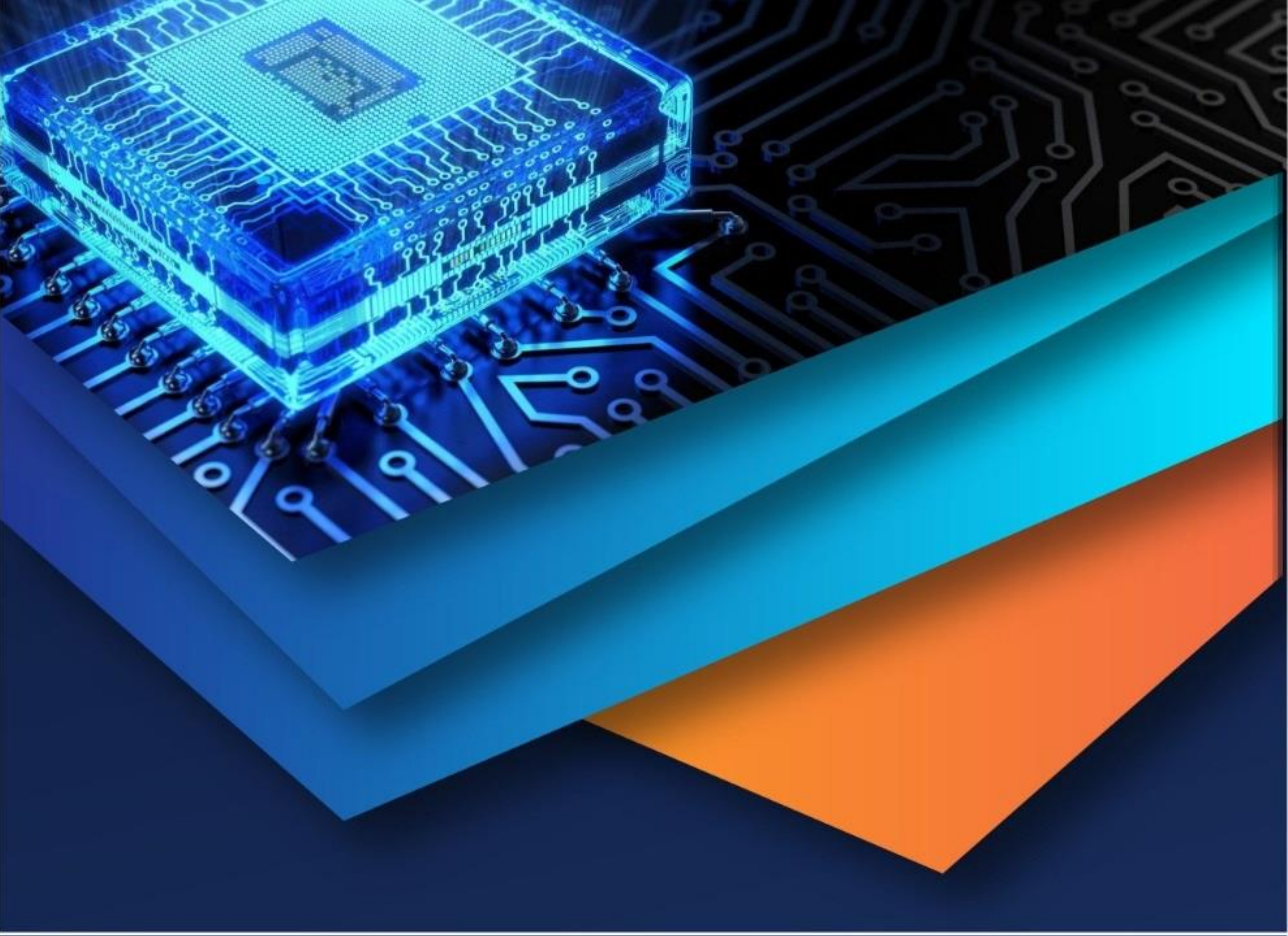


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