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# Study On The Behaviour Of Rc Structures Under Seismic Forces

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***Abstract***

*Bracing system in structural frame provides an excellent approach for strengthening and stiffening existing building for lateral forces. Concrete shear wall has better seismic performance due to improved lateral stiffness and lateral strength. The provision of masonry infill walls behaves like compression strut between column and beam and compression forces are transferred from one mode to another*

*In this paper, different types of bracings are used namely X,V,inverted V shaped bracings with shear wall and infill wall. A model of G+14 storeys is considered, a comparison of structural behavior in terms of base shear, storey displacement, time period and storey drift characteristics are carried out with 7 different types of models with shear wall , infill wall and various types of bracings. These frames are known to be efficient structural systems for buildings under high lateral loads such as seismic loadings. The fact that the lateral resistance of frame can be significantly improved by the addition of this technique has led to the idea of retro fitting seismically inadequate reinforced concrete frames.*

*It is found that the inverted V shaped bracings with shear wall in longitudinal direction is more efficient for seismic forces out of all other types of models.*

***Keywords:*** *Bracing system, Base shear, Infilled frames, Shear wall, Storey displacement, Time period*

***Introduction:-***

Skyscrapers have been around since the so-called “Chicago-style” architecture arose in the 1880’s. Developers routinely seek to push the envelope on height in order to gain more rentable space, and make the structure economically viable. Bloomberg reports today that a mile-high skyscraper may be possible by 2025. Exactly what are we proving to ourselves by designing and building structures this tall? Is there a height limit on cost-effectiveness?

The consensus is that any building over one kilometer tall will require two or three buildings at the base, with connections between or among them at higher elevations in order to provide stability and bracing. To put this height in perspective, the BurjKhalifa in Dubai, the current tallest building, is 818 meters. Tall buildings require sophisticated methods of getting people up and down. Sophisticated methods of transport cost money. The more robust bracing and structural systems required for such buildings also cost money. (At a mere 452 meters, the Petronas Towers in Malaysia provide an example of bracing.) to withstand the lateral loads, lateral resistive system is put into use which is based upon the construction of shear walls, infill walls and different types of bracings.All these are used without much increase in the dead weight of the building.



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**Literature references:-**

**Anshuman S**.et al.performed elastic and elasto-plastic analyses using STAAD Pro and SAP V 10.0.5(2000) on a fifteen storey building located in earthquake zone IV and calculated bending moment and storey drift in both the cases. Shear forces and bending moment were considerably reduced after providing shear A Review On Shear Wall In High Rise Buildings www.ijeijournal.com Page | 20 wall. It was observed that the inelastic analysis performance point was small and within elastic limit therefore results obtained using elastic analysis are adequate

Dr**. B.Kameswari** et.al studied the drift and interstorey drift of a high rise structure for different configuration of shear wall panels and compared it with that of bare frame. The configurations considered are (1)Conventional shear walls(2)Alternate arrangement of shear walls(3)Diagonal arrangement of shear walls (4)Zigzag arrangement of shear walls(5)Influence of lift core walls.The zigzag arrangement of shear wall was found to be better than other configurations as it enhances the strength and stiffness of the structure by reducing the lateral drift and inter storey drift than other types of walls and is most effective in earthquake prone areas.

**Bhagwagar** studied the effects of steel and other ductile materials as well as steel plates, while **Di Sarnoand Elnashai** focused on frame bracing, all showing improvement in the overall structural response. Of the aforementioned the most easily applicable and readily available material is masonry infill. It can therefore be considered as a rather interesting solution for frame structure's seismic rehabilitation despite the apparent shortcomings in terms of additional weight added to the structure.

**Objective of the study**

(1).To study the behavior of RC structure under linear static analysis

(2).To study the behavior of various bracing system on RC structure

(3).To study the effect of shear wall on the RC structure

(4).To study the beheaviour of RC structure with both shear wall and bracings

(5).To know the time period, base shear and storey drift of the RC structure

(6).To obtain the most efficient type of bracing system for RC structure

**Methodology**

(1). The building is designed according to the IS: 456-2000 with the existing load cases namely dead load, live load and earthquake loads.

(2). The building is analysed for linear static analysis.

(3). The plan dimension of the designed building is 25x25m with the bay dimension of 5x5m. It is analysed with various bracing system and shear wall.

(4). Result data obtained from response spectrum analysis is compared with bare frame.

**Modelling and Analysis**

The structure is analysed for seven different types of models as shown below:--

**Table 1**

| Model No. | Various types of models |
|---|---|
| 1 | Bare frame |
| 2 | Bare frame with X-Bracings at outer corners |



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| | |
|---|---|
| 3 | Bare frame with V-Bracings |
| 4 | Bare frame with inverted V-Bracings |
| 5 | Bare frame with shear wall in lateral direction |
| 6 | Bare frame with shear wall in longitudinal direction |
| 7 | Bare frame with X bracings and shear wall in longitudinal direction |

**Table 2: Structural Description**

| | |
|---|---|
| Column size | 300x900 mm |
| Beam size | 300x600 mm |
| Thickness of slab | 150 mm |
| Thickness of shear wall | 300 mm |
| Grade of rebar section | Fe 500 |
| Bracings | X Bracing |
| | V Bracing |
| | Inverted V Bracing |
| Dead Load | 1.5 KN/m |
| Zone | V |
| Response reduction factor | 3 |
| Importance factor | 1.5 |
| Soil strata | Soft soil |
| Height between two floors | 3m |
| Grade of steel section | Fe 250 |
| Grade of concrete | M25 |
| Bracing | 200x200mm |
| Live load | 3.5 KN/m |

**Results and Discussions**

An RC structure of G+14 storeys with brace frame and shear wall for soft soil was analyzed. The variation of base shear, time period and storey displacement was studied and compared with bare frame structure. Following is the plan and 3D view of different types of models.

**Time period**

Time for body to complete one cycle of freevibrations is known as time period.



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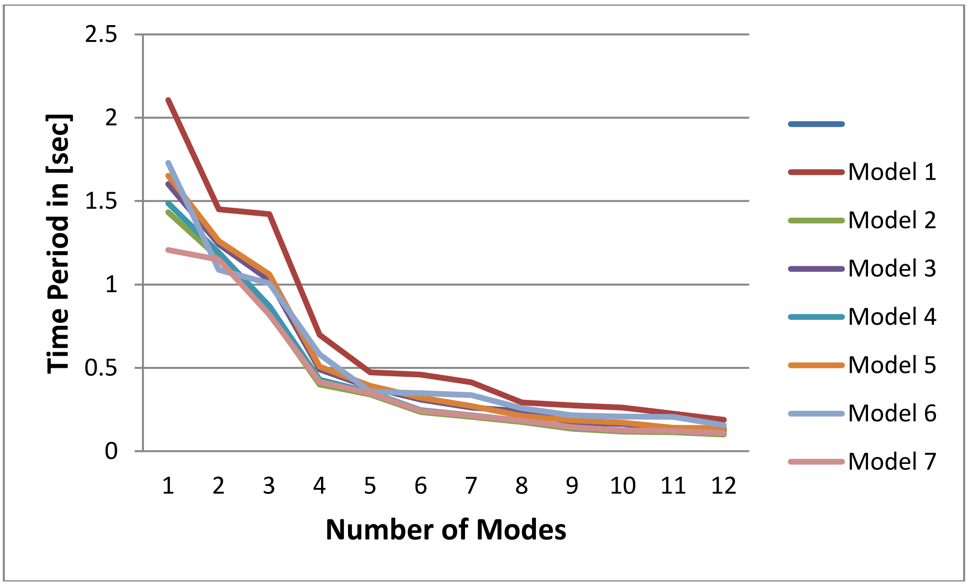


**Fig 9: Variation of time period**

From the above graph, it can be observed that the time period o structure decreases by the provision of lateral resistive system. Time period of the RC structure reduces by 51.09% in model 7. This model has bare frame with inverted V bracings with shear wall in longitudinal direction.

**Base shear**

Base shear is the maximum seismic force that occurs due toaction at the bottom of the building.

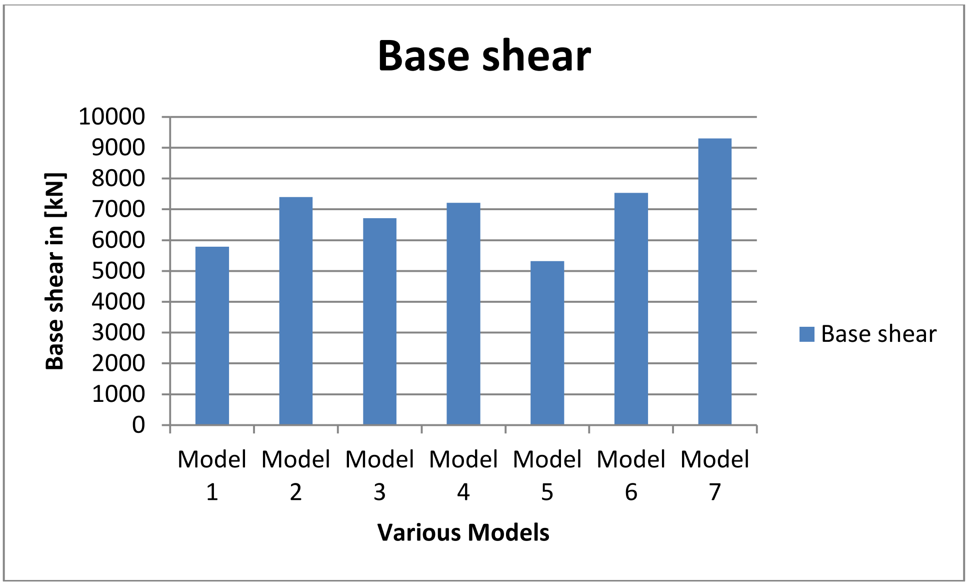


**Fig 10: Base Shear**



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### Observation and discussion

From fig 10, it is observed that base shear of the rc structure increases by the provision of lateral resistive system. Base shear of the RC structure increases by 73.38% in model 7, that is bare frame with inverted V bracings with shear wall in longitudinaln direction.

### StoreyDisplacment

Storey displacement can be defined as the displacement of storey initial position to final position due to seismic ground motions.

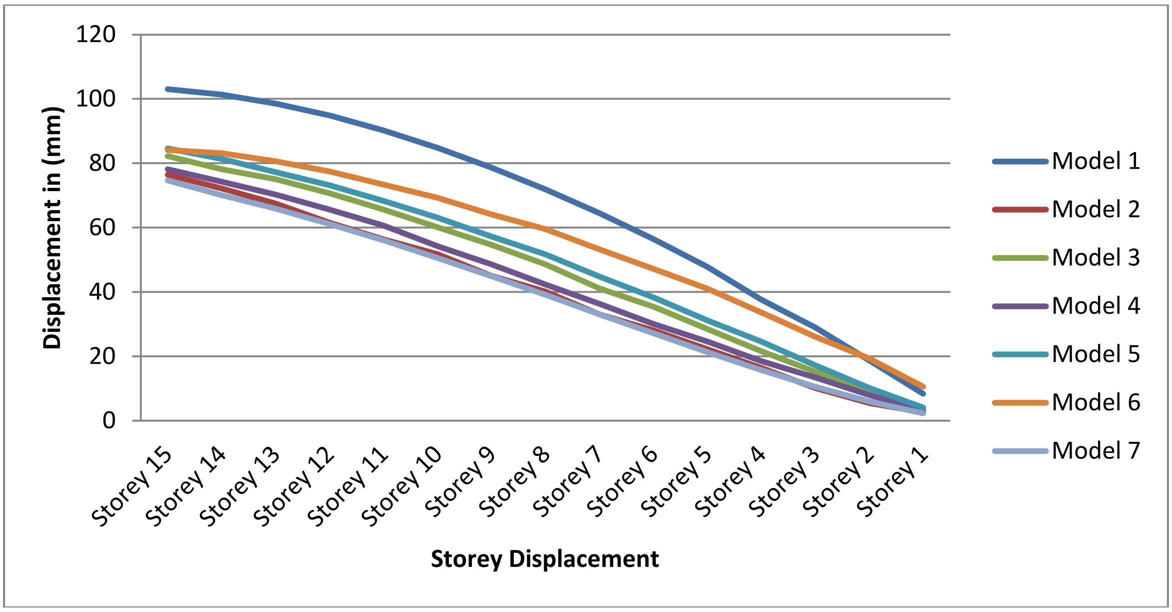


**Fig 11: Storey Displacement**

### Observation and discussion

From fig 11 it is seen that storey displacement of structure reduces by the provision of lateral resistive system. Storey displacement of the RC structure is reduced by 61.25% in model 7, that is bare frame with inverted V bracings with shear wall in longitudinal direction.



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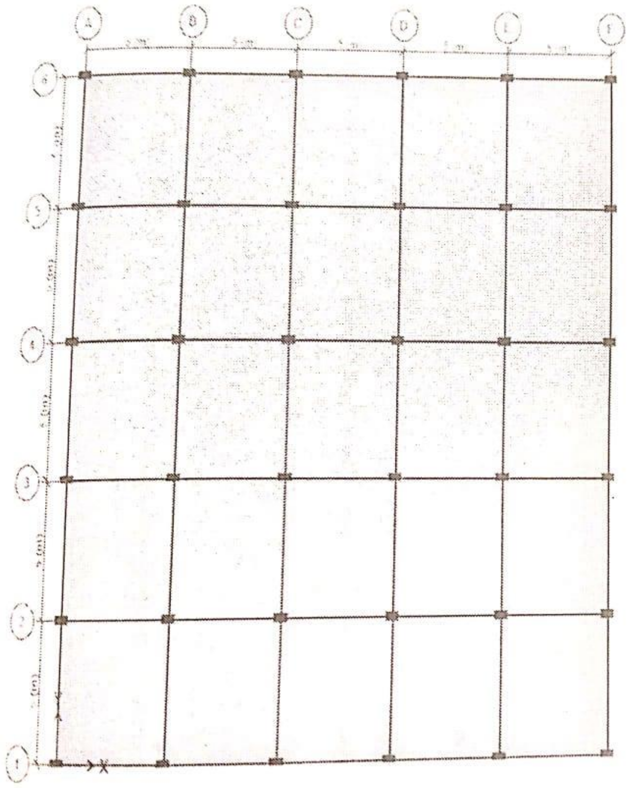

**Fig 1: Plan**

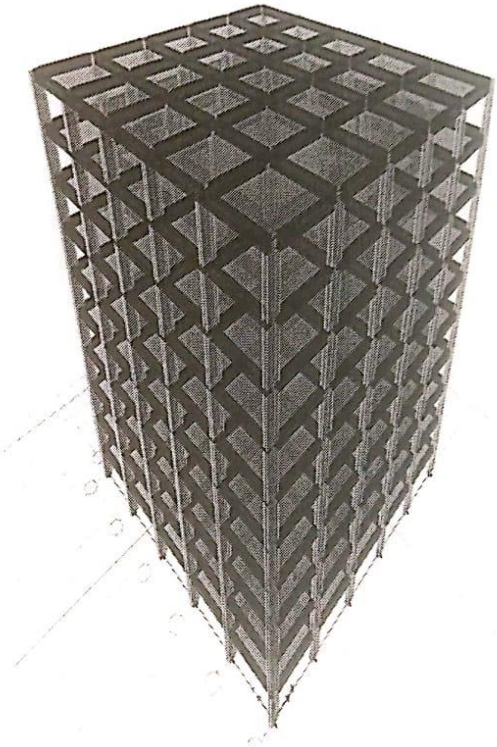

**Fig 2: Model 1**



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Fig 3: Model 2

Fig 4: Model 3

Fig 5: Model 4

Fig 6: Model 5



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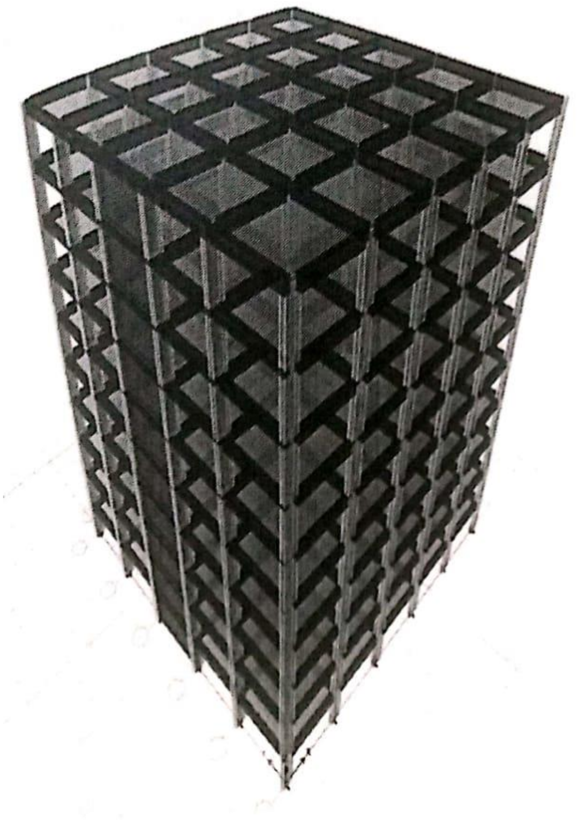

**Fig 7: Model 6**

**Fig 8: Model 7**



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**Conclusion:-**

1. Provision of lateral resistive system in the RC structure decreases the yime period, storey displacement and increases the base shear
2. Out of the various types of bracings provided at outer periphery such as X , V, and inverted V bracings, inverted V bracings are the most effective.
3. Shear wall is provided in both the longitudinal and lateral direction out of which the shear wall in the longitudinal direction reduces the time period and storey displacement and increases the base shear to the maximum extent.
4. The reduction of time period due to inverted V b racings is calculatyed to be 51.09% when compared tp the bare frame structures.
5. Reduction of storey displacement because of inverted V bracings and shear wall in the longitudinal direction amounts to 61.25%
6. The base shear increases by 73.38% due to the addition of inveted V bracings and shear wall in longitudinal direction.

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