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"COMPARATIVE ANALYSIS OF MULTISTORY BUILDING WITH AND WITHOUT SHEAR WALL, X BRACING AND FLUID VISCOUS DAMPERS"

Divya R Hangal[1], Sri. Raghu M E[2]

[1]*Post Graduate student, Structural Engineering, Bapuji Institute of Engineering and Technology, Davangere, Karnataka, India*
[2]*Assistant Professor, Structural Engineering, Bapuji Institute of Engineering and Technology, Davangere, Karnataka, India*

Abstract - According to seismic records, there is an increase in the need for earthquake-resistant buildings, which can be met by providing shear wall, X bracing or Fluid viscous dampers. Due to wind, earthquake and additional forces, lateral forces generated in the wall's plane. In R.C.C building without shear wall, bracing and FVD the displacement can be seen more.so by placing shear wall, X bracing and Fluid viscous dampers at the proper position it resists the lateral loads and provides the stiffness to the structure. The analysis is by carried out of R.C.C building with placing shear wall, X bracing and fluid viscous dampers at corners of the building by using response spectrum analysis in ETABS software.

Key Words: **Lateral forces**, **shear wall, X bracing, Fluid viscous dampers, Response spectrum analysis.**

1.INTRODUCTION

Reinforced concrete is widely used in building industry. Hence every civil engineering programmer must have basic understanding of the fundamentals of reinforced concrete.

In order to provide adequate support, the building and to withstand the natural disaster like earthquake many research and analysis has been carried out. The study of seismic behavior of a structure is been checked by using important criteria and that has been carried out numerous investigations and that analysis mainly depend upon elastic and natural behavior of the structure. The torsional drift displacement and extra force which are acting over the period of time to the structure. The structure can withstand mainly depend upon the center of mass and also considering center of rigidity and considering its figure it explains kind of seismic behavior that the structure is going to withstand.

1.1 Shear wall

The reinforced concrete (RC) structure which have plate like RC walls are called as shear walls in more to slab, column and beam. These walls are constructed at foundation level and spread continuous throughout the building height. The thickness of a shear wall can be minimum of 150mm to maximum of 400mm in high rise buildings. The shear walls are constructed along length and width of a structure.

1.2 X bracing system

In India the RCC structures with the provision of bracing system is very rare in feature. This feature is very much desirable where the construction carried out in seismic areas. By providing bracing system to the structure, it can reduce or eliminate the effect of earthquake.

1.3 Fluid viscous Dampers

Fluid viscous dampers are also referred as the hydraulic device that when stroked it dissipates the energy placed on the structure by seismic action. To reduce the seismic damages also to improve its performance of a building many creative ideas of earthquake designing are carried out using proper demonstrating of structure with new techniques. Fluid viscous dampers (FVD) are used to examine the response of an RCC structure when they are affected to lateral loads and to resist the lates and to absorb the energy FVD are used.

2. LITERATURE REVIEW

Mr. K Lovaraju et .al (2015) investigated the non-linear analysis of frame to identify effective position of an shear wall in an multistory structure. Four model of an eight-story building were subjected to an earthquake load, and ETABS was used to locate shear walls at various locations throughout the seismic zones. It was concluded that installing shear wall in an appropriate position is more relevant if base shear and displacement also lessen earthquake related displacement.

Chandurkar and pajgade (2013) investigated that changing position of shear wall will influence the fascination of powers so that wall should must be put in legitimate position. Concluded that in case the measurement of shear wall are huge the major sum level drive are taken by shear wall conjointly giving the shear wall at appropriate position it can decrease the displacement of an structure due to seismic tremor.

S Amir and H Jiaxin(2014) investigated the use of viscous dampers under seismic and wind loads, finding that they greatly reduces the energy loss and reduces the vibration in most structure.it is described how a damping system need a non-linear characteristics in order to lessen vibration.

Tejas D Joshi (2013) investigated high rise steel structure bracing system. For the purpose of the analysis, he considered G+15 story building that used a variety of bracing systems, including X bracing, double X bracing, single diagonal bracing and V bracing. according to the study braced building offer a higher level of displacement reduction than unbraced ones. When compared to unbraced building structures, storied drifting braced building can change.

D.k. Paul (2012) proposed a realistic implementation on an earthquake-resistant building in order to withstand nonlinear lateral seismic stresses.in order to enhance performance, retrofitting is used, in which chevron bracing and an aluminum shear links as a beam are installed. It is found that by using the shear link, the building becomes are more responsive and capable of sustaining lateral stresses.

3. OBJECTIVES

1. Comparing the seismic behaviour of a structure with and without a shear wall, fluid viscous dampers, and a bracing system is the primary goal of this study.

2. To analyse the displacement changes in the structure by providing different shear parameters.

3. To investigate the seismic properties using the response spectrum approach for the identical structure with and without a shear wall, X bracing and FVD.

4. To study the efficiency of shear parameters by following point of view:

    a) Maximum displacement
    b) shear
    c) Combined stress

5. To determine which structure gives superior results by placing shear parameters.

4. METHODOLOGY

The analysis was conducted utilizing the software ETABS for the analysis purpose in order to discover the fundamental elements like displacement, Drift, Story Shear and Story Stiffness. For the analysis Response Spectrum method is adopted.

4.1RESPONSE SPECTRUM ANALYSIS:

Response spectrum analysis is a nonlinear dynamic statical analysis technique that representing the maximum seismic response of an elastic structure by evaluating the data from each natural mode of vibration. It is one of the best methodologies to determine the particular mode of vibration for 85% for the base reaction and 90% for response reduction factor under highest standard so response spectrum analysis is highly permitted under the method and known as sum of root of sum of square and other method which is popularly used is complete quadratic combination to get the accurate value.

Table 1: Building dimension

Sl. No	Name of the model	Description	Height, m
1.	Model 1	RCC structure	30
2.	Model 2	Structure with shear wall	30
3.	Model 3	Structure with FVD	30
4.	Model 4	Structure with X bracing	30

4.2 Material property which is used in this model are following;

Grade of concrete = M35

Grade of steel = Fe550

Geometry of model

Depth and width of beam = 460x600mm

Depth and width of column = 600x600mm

Slab thickness = 200mm

Shear wall thickness = 200mm

Floor height =3m

Multi Story building total height = 30m

4.3 Load consideration:

1. Dead load is permanent load which cannot vary, which is constant load which include the beam, column and slab weight. This dead load assigned according to codal provision as per IS 875-Part 1(1987).

2. Live load is the load. Load is not a permanent load. Which is like a temporary load which load is any time add or remove from any situation. This live load is also assigned according to codal provision as per IS 875-Part2(1987).

3. Earthquake Load (EL) Which is also called as dynamic load this load is sudden in nature and caused vibration to the building. Agitation is created in building which is caused by the earthquake. The earthquake or horizontal load is assigned according to as per the IS 1893-2002(Part1).

The details to be considered for earthquake load is

- Zone factor take into = 0.16
- Importance factor consider= 1.5
- Response reduction factor in this all models = 3
- Condition of soil = Medium
- Damping percentage = 5%

Load combinations:

1.5(DL+LL)

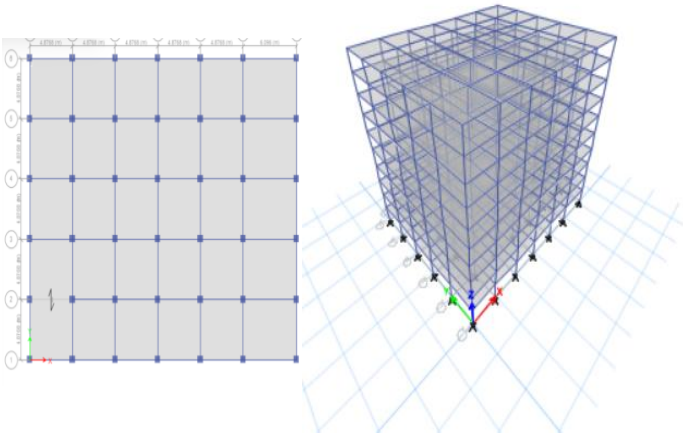
1.2(DL+LL±EL)

1.5(DL±EL)

0.9DL±1.5EL

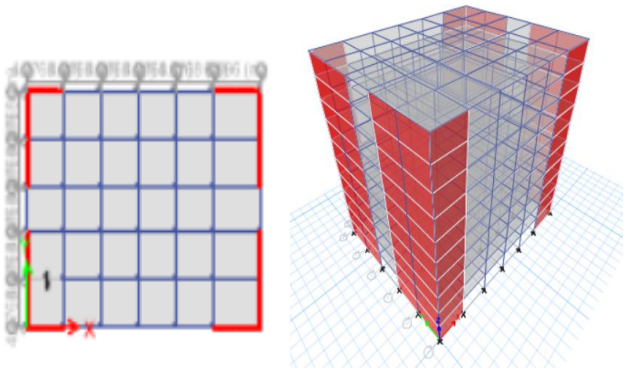
4.4 Modelling and analysis

MODEL 1



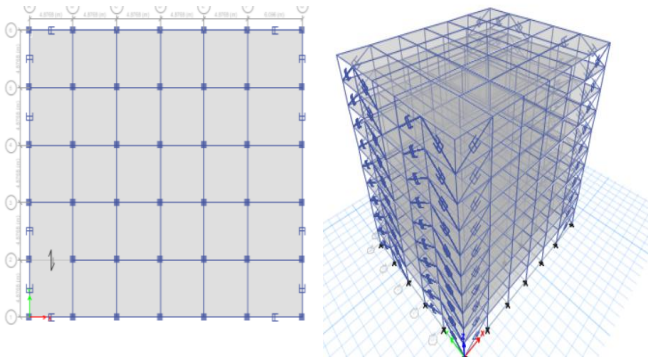
Model 1: plan and 3D view

MODEL 2



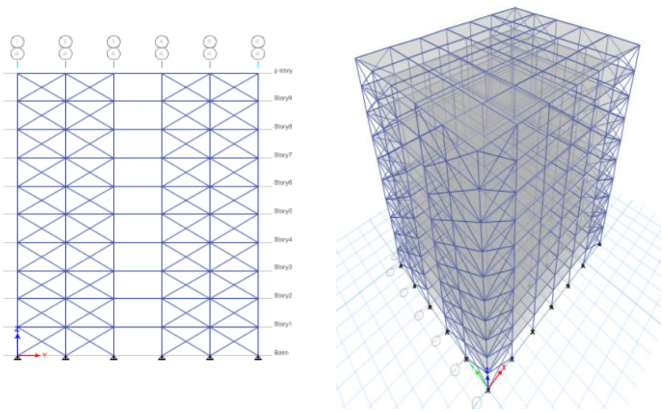
Model 2: plan and 3D view

MODEL 3



Model 3: plan and 3D view

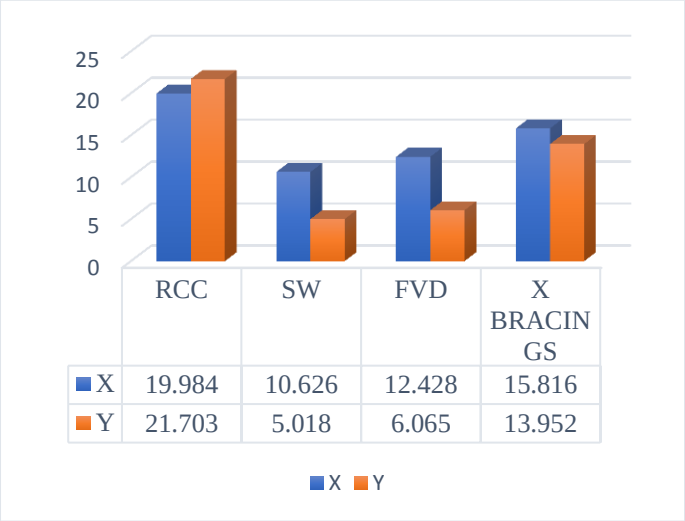
MODEL 4



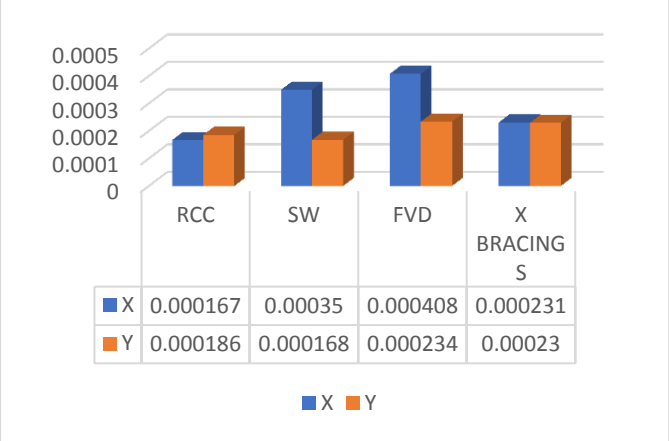
Model 4: plan and 3D view

5.RESULTS AND COMPARISION

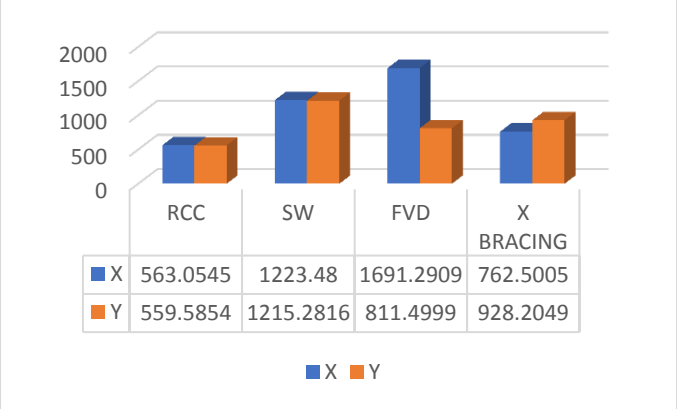
Maximum story Displacement



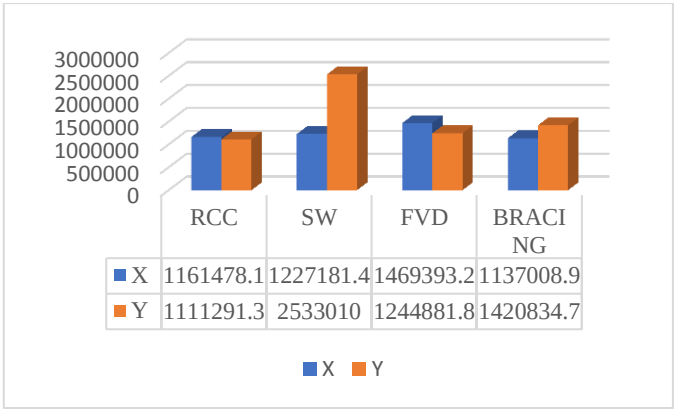
Maximum story drift



Maximum story shear



Maximum story stiffness



Conclusion

1. In the present study the final comparison is made for multistorey building with and without shear wall, X bracing and fluid viscous dampers placing at the corner.

2. By comparing multistorey building with and without shear parameters the displacement reduces by placing shear parameters at corner position.

3. By considering the results displacement reduces more by placing shear wall at corners than the placing X bracing and Fluid viscous dampers.

4. By placing the structure with shear wall, bracing and fluid viscous it can reduce structural damage due to the earthquake and resist the lateral force compared to normal RCC structure.

5. We can conclude that among the four models by placing the shear wall at the corners gives the best results considering displacement get highly reduced and also story drift reduces gives more stiffness to the structure compared to x bracing and fluid viscous dampers.

6. By considering displacement and stiffness values fluid viscous dampers shows the good results it can be considered for the second choice.

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