Scientific Journal of Impact Factor (SJIF): 5.71
e-ISSN : 2348-4470
p-ISSN : 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5,Issue 5,May -2018

STUDY ON THE EFFECT OF VISCOELASTIC DAMPER IN SOFTSTOREY BUILDING

Indusree Nair[1], Chinnu Sara Prasad[2],

[1]P G student, Department of Civil Engineering, Sree Narayana Institute of Technology, Adoor, Kerala
[2]Assistant Professor, Department of Civil Engineering, Sree Narayana Institute of Technology, Adoor, Kerala

Abstract — *In this work the seismic analysis of a softstorey building is carried out by introducing viscoelastic damper. Delhi is the third earthquake prone city in India and hence the structures must be constructed to withstand the seismic effect. Thus to control the seismic performance, it is necessary to install dampers. Then the structure model is analysed using ETABS. The result shows the reduction of seismic response of softstoreid building by using the viscoelastic dampers.*

Keywords- *softstorey building; viscoelastic damper; hybrid coupling mechanism; brace type damper mechanism ; response spectrum*

I. INTRODUCTION

Nowadays, high rise buildings are constructed with parking facilities in the bottom floors. Sudden reduction in lateral strength and stiffness of these bottom storeys due to absence of masonry wall at these storey results in excessive inelastic deformation on the columns in these storeys leading to the soft-story collapse of the building under the seismic loading conditions. Use of dampers can reduce the seismic response of this structure by increasing the damping effect. Damping plays important role in design of multistoried structure, which reduces the response of the structure. There are different types of dampers in use. In this study Viscoelastic coupling dampers (VCD) are used to evaluate the response of softsorey building. During earthquake, this VCDs can add more distributed damping in all lateral modes of vibration by activating the fuse elements and providing distributed viscous damping to the structure.

In this work the seismic characteristic of a building under construction in Delhi is analysed by introducing viscoelastic coupling damper. Delhi is the third earthquake prone city in India and hence the structures must be constructed to withstand the seismic effect. Thus to control the seismic performance, it is necessary to install dampers. The building frame is modelled as open in below three storeys. Viscoelastic dampers are provided in these open storeys to check the seismic performance of the structure. Structure is modelled with open storeys upto 3 storeys. Finite element analysis was carried out using the software ETABS version 9.7.2.

II. VISCOELASTIC DAMPERS

The concept of seismic behaviour control has been taken as an important factor in the design of structures. More economical design of the system can be achieved by adding innovative devices to reduce the forces and deformations in structures. By modifying the dynamic properties of the system, these devices aim to control the response of the structural members. VE dampers dissipates energy through shear deformation when loaded. The most important characteristic is that the properties are functions of the excitation frequency and the environmental temperature. The VCD consists of multiple layers of viscoelastic material, placed between layers of steel plate which are anchored at alternating ends to the coupled RC walls. These VCD elements replace some of the RC coupling beams in coupled wall buildings to provide added distributed damping. During the event of an earthquake, the fuse elements inside the damper activates, limiting the forces transmitted to the adjacent RC walls. The VCDs are easily inspected following a major seismic event, and can be readily repaired or replaced.

III. BUILDING MODEL DETAILS

The structure considered is a G+13 apartment building located at Delhi, India. The building is chosen such that it is located in high seismic zone. Building have a typical plan and have a typical storey height of 3m. Beams and columns are modelled as frame elements and slabs are modelled as shell elements. Shearwall is modelled with piers.

Table 1. Model Details

Element Name	Size(mm)
Beam	230x500
column	230x600
slab	120

3.1. Analysis of structures

Building is modelled as open at below three storeys. Response spectrum method of analysis is used. They are shown in figure 1, 2, and their descriptions are mentioned in Table 2. In hybrid coupling mechanism, damper is provided in lieu of coupling beam between two adjacent shearwalls.

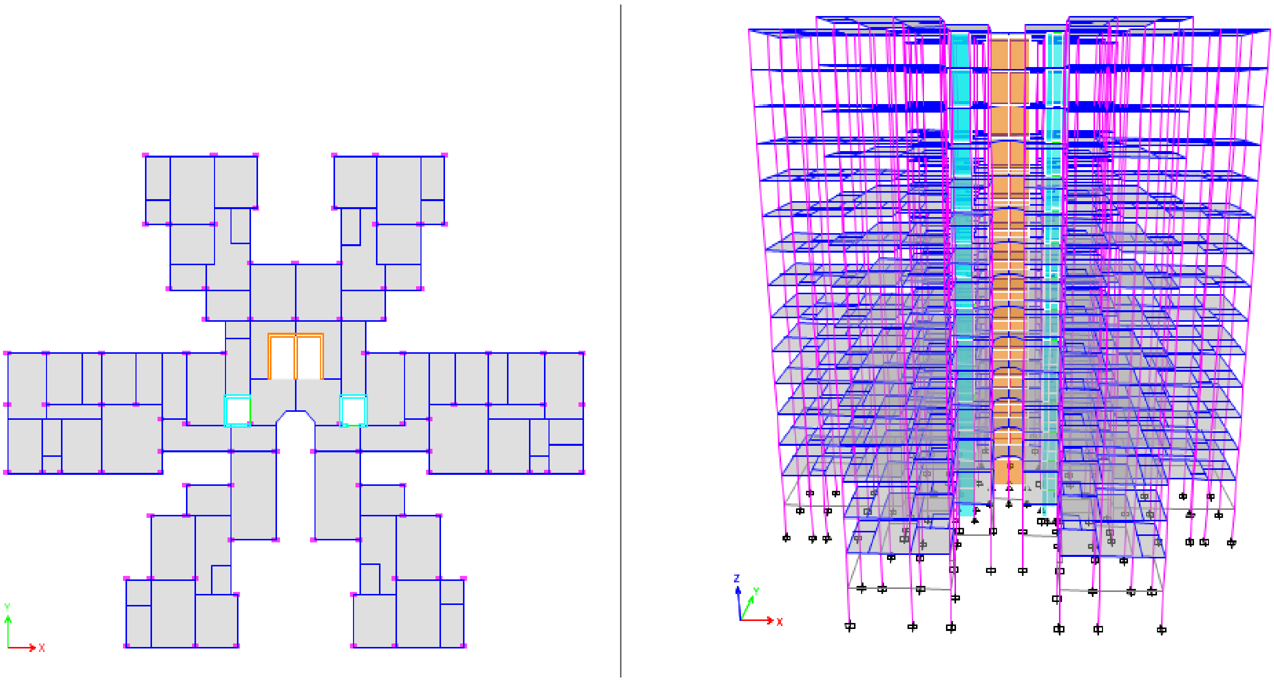

Figure 1. Plan and elevation of model R(bare structure)

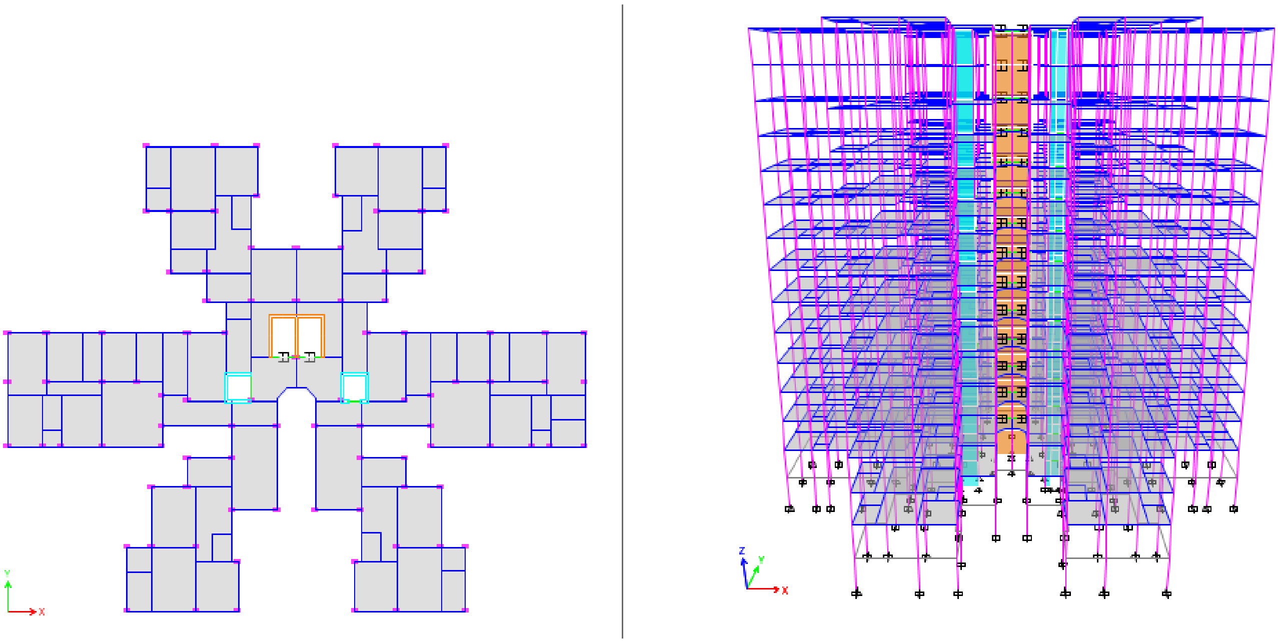

Figure 2. Plan and elevation of model A

Table 2. Model details

Name	Description
R	Ordinary shearwall structure with softstoreys upto 3 stroreys without damper taken as reference structure
A	Structure with softstoreys upto 3 stroreys and with brace type damper mechanism in all floors
B	Structure with softstoreys upto 3 stroreys and with hybrid coupling mechanism

Response spectrum analysis is carried out with damping ratio of 5%. Seismic parameters considered are shown in Table.3.

Table 3. Seismic Parameters considered

Seismic zone	IV
Zone factor	0.24
Soil type	medium
Importance factor	1.5
Response reduction factor	5

. 3.2. Damper details

The damper properties are selected with reference to literature papers by R Kazi, P V Muley, P Barbude[3] and M L Lai[7]

Table 4. Damper details

Damper used	Viscoelastic damper
Model	3M ISD 110
Stiffness	20000KN/m
Damping coefficient	10000KNs/m

IV. RESULTS

Each model has been analysed using Etabs 2015 version 9.7.2. The results are obtained for the most critical load condition. Results are obtained on the basis of response spectrum analysis result of model with and without dampers.

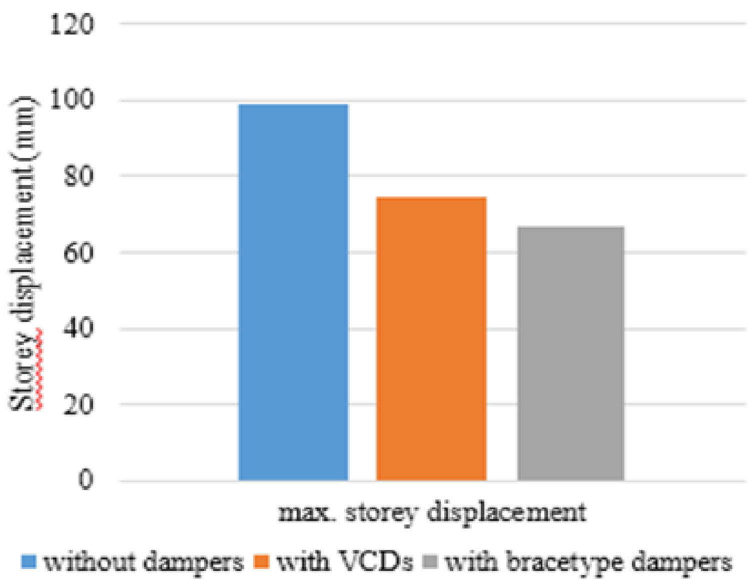

Figure 4. Storey displacement for earthquake

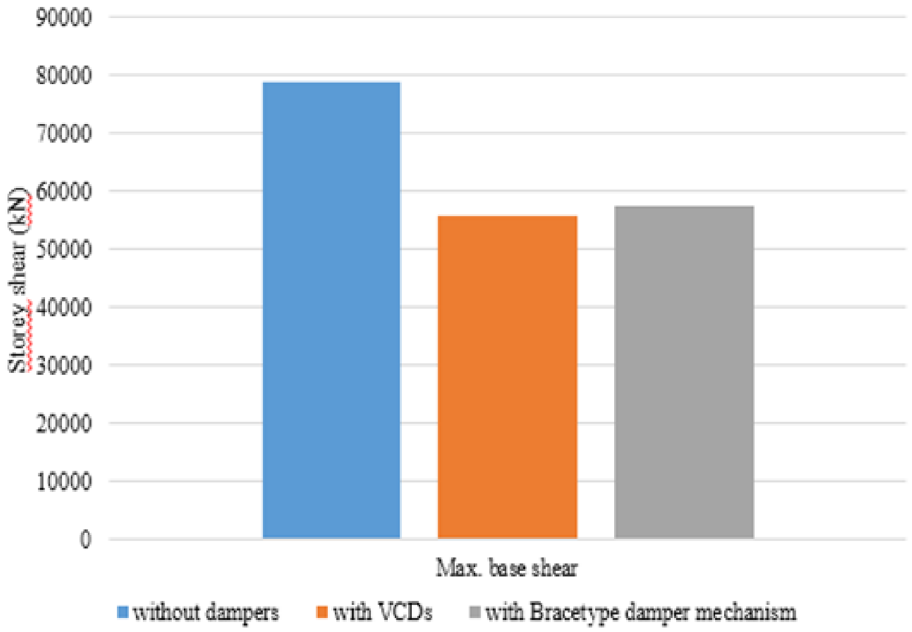

Figure 5. Storey shear for response spectrum modal case.

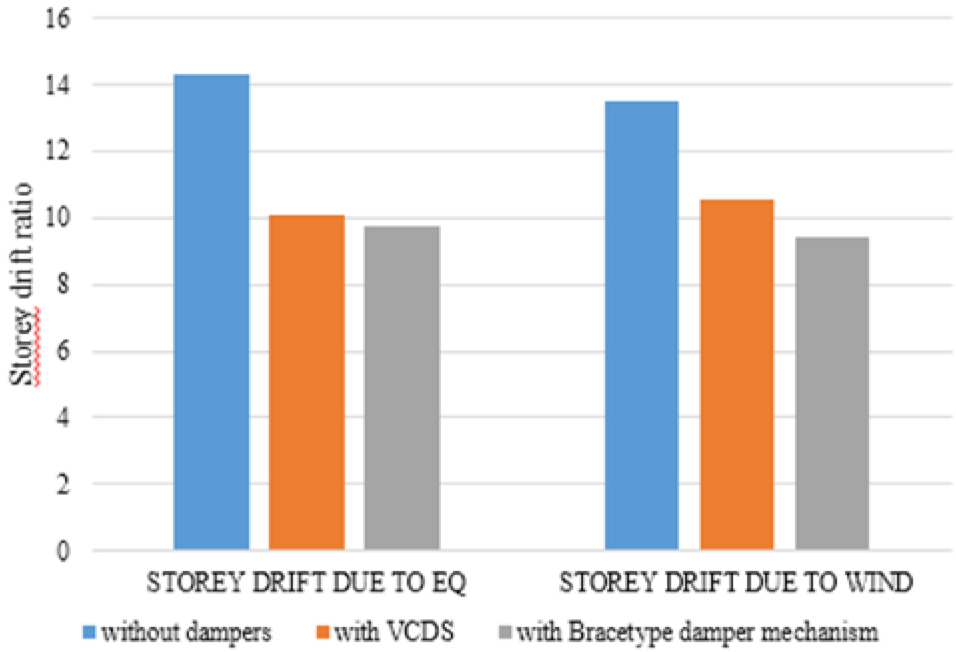

Figure 6. Storey drift .

Table 5. Average reduction in storey responses

Configuration	Drift		Storey displacement (%)	Base shear (%)
	due to earthquake (%)	due to wind (%)		
With brace type dampers	31.98	30.52	43.09	18.84
With VCDs	29.68	21.73	36.24	19.86

V. CONCLUSION

From the results obtained on the basis of response spectrum analysis for each configurations A and B with reference to that of bare structure R, following conclusions were made:

1. Table 5 shows that the use of viscoelastic damper as brace type damper mechanism can reduce storey responses due to earthquake.
2. Thus, for softstory building, brace type mechanism was more effective than hybrid coupling mechanism.
3. The percentage reduction in storey drift was more in case of brace type mechanism than that of hybrid coupling mechanism for soft storey building.
4. The results shows that it is effective to use viscoelastic dampers in soft story building at high risk zone.

REFERENCES

[1] Nikhil Shedbale, Prof P.V. Muley, Prof P.Barbude, “Performance Based Placement Of Visco-elastic Dampers In An R.C.C Building” IJEDR Volume 5, Issue 3, 2017.
[2] Devang B. Lad, Ashish K. Sanghavi, Komal M. Panchal, Prashant R.Barbude, “Analysis of G+35 Storey RCC Building using Viscoelastic Damper on ETABS”, pg 677-687, Volume 4, Issue 5, May 2017
[3] R.Kazi, Prof. P. V. Muley, “Comparative Analysis of a Multistorey Building with and without Damper ” IJCA, ICQUEST2015.
[4] Abdul Qadir Bhatti,”Performance of viscoelastic dampers under various temperatures and application of magnetorheological dampers (MRD) for seismic control of structures”, Springer Science, pp 275-284, 2012
[5] Symans, M. D., Charney, F. A., Whittaker, A. S., Constantinou, M. C., Kircher C. A., Johnson M. W., McNamara R. J., "Energy Dissipation systems for Seismic Application: Current Practice and Recent Developments", J. of Structural Engineering, ASCE, 134(1), 2008, 3-21.
[6] K.C. Chang, Y.Y. Lin and M.L. Lai, December 1998 “Seismic Analysis and Design of Structures with VE Dampers”, ISET journal of Earthquake Technology, Paper no 380, Vol 35, No 4, pp. 143-166
[7] M.L Lai, D.A Lunsford, K. Kasai, P.Lu and K.C. Chang 1996, “ViscoElastic damper. A damper with linear or non linear material?” Eleventh World Conference on Earthquake Engineering. Paper no 795
[8] K. L. Shen, T. T. Soong, “Modeling Of Viscoelastic Dampers For Structural Applications” , ASCE, 1995

