International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 02 | Feb 2020 www.irjet.net p-ISSN: 2395-0072

A Review of Seismic Analysis of Different Shape of RC Building by using the Viscous Damper

Chandra Kumar[1], Ramendra Kumar Singh[2]

[1]*Student of Civil Engineering & Lucknow Institute of Technology, Lucknow.*
[2]*Assistant Professor & Lucknow Institute of Technology, Lucknow.*

Abstract - *The large number of the RCC building constructed in all over country in the earth prone area and In this review paper we study about paper which is related to the seismic analysis of RCC building by using the different type the damper in the building. After study all research paper we gave the conclusion in this paper of the different shape of the RCC building with different height in different seismic zone the help of the viscous, mass damper. The Analysis of RCC building mainly done with the help of time history analysis in the Etabs Software in all research paper. In the most the paper the viscous damper are placed at the different position in the RCC building. The main purpose of this paper to study the effect of the viscous damper on the different type of the building and which building is most stable.*

Key Words: Time history, Mass damper, Viscous damper, RCC building, Etabs

1. INTRODUCTION

From the past earthquake records, the world has experienced number of destroying earthquakes, causing in number of increase the loss of human being due to structural collapse. Because of such type of structural damages, during earthquake hazards clearly explains that the buildings/ structures maybe residential buildings, public life-line structures, historical structures (structure which represent the some past memory of the place) and industrial structures should be designed to seismic force design and very carefully to overcome from the earthquake hazards. The approach in structural design using seismic response control device is now widely accepted for structure and frequently used in civil engineering field. Serious efforts have been undertaken to develop the structural control concept into a workable technology and such devices are installed in structures. The structural control system is usually classified by three methods. The three classes of structural control system are dissipation of active energy, dissipation of semi-active and dissipation of passive energy. The passive energy systems are devices which are used to dissipate the seismic effect on the structure or vibration of the structure due to shaking of the ground of release of the seismic wave. The important function of the passive devices is to absorb a part of earthquake energy which effect on the structure i.e., input energy, reducing earthquake energy or force on structural members and to reducing the percentage of the damage to the structures. Comparing to semi-active or active systems there is no need of external power supply to passive control system. The active control system is controllable and requires some amount of external supply in processing.

1.1 Viscous Damper

Viscous damper is used for the dissipation of energy in the structure which is produce due to earthquake or that occurs when a particle in a vibrating system is resisted by a force the magnitude of which is a constant, independent of displacement and velocity, and the direction of which is opposite to the direction of the velocity of the particle.

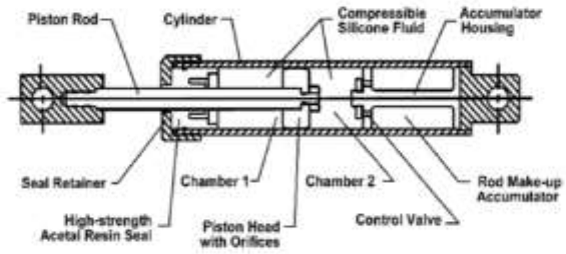

Fig -1: Viscous damper

2. Literature Review

We study the following paper which is related to the Seismic analysis of the RCC building by using the different type the damper.

[2.1] K. Kasai[1] A. Wada[2] [2008]

In this paper the author used different type of the damper i.e; viscous dampers, steel dampers and visco-elastic dampers. The main conclusion of paper is the average inter-story drift and shear forces of columns can be reduced nearly one-half compared to the frame without dampers.

The viscous dampers have better control effect of displacement, especially under moderate earthquake and major earthquake than the other type of the damper. The dampers can dissipate a large amount of energy and the force-displacement curves of dampers are very full. The ratio of actual damping forces to the expected damping force under moderate earthquake indicates that the initial damper parameter design is proper.

[2.2] Benita Merlin Isabella[1] , Dr. Hemalatha[2][2017]

In this study the seismic response of the building is analyzed when it is connected with various passive dampers and subjected to earthquake of intensity 6 Storey benchmark building is modeled and analyzed using SAP2000. Time History Analysis method is used for dynamic analysis. After the analysis results for passive dampers are obtained and compared and the results are as follows.

i. The RCC building without the masonry wall is analyzed without passive damper and its displacements are 79.6mm, 22.5mm and 22.1mm when subjected to Elcentro 1940, Northridge and Imperial Valley.

ii. The Displacement results obtained after the connection of dampers shows 55% displacement reduction for VED, displacement reduction for 73% friction damper, displacement reduction for VISCOUS FLUID DAMPER 79%.

iii. Inter-Storey drifts are within the permissible limit for all the passive dampers.

iv. The value of the Base shear for the Bare frame with the Friction damper is higher when compared to the Viscous Fluid Damper, Visco-elastic damper.

[2.3] Rakesh Patwa[1], Dr. Savita Maru[2] [2018]

This study explains the behavior of dampers on structural system under the performance of dynamic loads from which the following conclusion can be drawn, based on the result:-

i. The analysis shows that the time period of structure increases when Tuned Mass Damper and Viscous Fluid Damper are mounted because of these frequencies of structure reduces when compared with bare frame of RCC structure. As the frequency of structure reduces the dynamic effect on building also reduces.

ii. The value of response spectrum acceleration under time history analysis there are reduction about 17.0% of model Tuned Mass Damper and 27.0% of model Viscous Fluid Damper as compare to model without any damper in X direction after applied time history data . Similarly, The value of response spectrum acceleration under time history analysis there are reduction about 11.0% of model Tuned Mass Damper and 19.0% of model Viscous Fluid Damper as compare to model without any damper in Y direction after applied the time history data .

iii. The value of response spectrum velocity under time history analysis there are reduction about 9.0% of model Tuned Mass Damper and 19.0% of model Viscous Fluid Damper as compare to model without any damper in X direction. And reduction about 8.0% of model Tuned Mass Damper and 23.0% of model Viscous Fluid Damper as compare to model without any damper in Y direction.

iv. On observing the base acceleration value under time history analysis, there was reduction 2% in model TUNED MASS DAMPER and about reduction 7.68% in model with VISCOUS FLUID DAMPER in X direction for the same coefficient of damping for both.

v. The value of base displacement under time history analysis there are reduction about 3.0 % of model Tuned Mass Damper and 12.0% of model Viscous Fluid Damper as compare to model without any damper in X direction. Similarly, The value of base displacement under time history analysis there are reduction about 2.54% of model Tuned Mass Damper and 13.27% of model Viscous Fluid Damper as compare to model without any damper in Y direction.

vi. . After comparing all models it has been observed that the Viscous Fluid Damper's gave maximum reduction in responses (Base Shear, Displacement, Velocity, Acceleration) with compare to TUNED MASS DAMPER model for same damping coefficient.

[2.4] Puneeth Sajjan[1], Praveen Biradar[2] [2018]

The paper study by this all author And they gave the conclusion is as follows,

i. According to the obtained results, viscous damper in structure results in the decrease of building displacement and building drift.

ii. The bare frame model which is without damper is analyzed and obtained the results of displacement as 29.0 mm and story drift as 0.00181mm.

iii. The results obtained from the model with addition of viscous damper are displacement as 10.73 mm and story drift as 0.00055mm.

iv. By observing, the displacement values increases over the height of the structure.

v. From the comparison, the displacement value of the structure is reduced about 60% to 85% when viscous dampers are applied to the structure.

vi. With the placement of viscous damper into the structure maximum drift reduces in the structure during seismic loading.

vii. By using viscous damper in the structure, the story drift at mid-stories is reduced by 70% when compared with bare model.

viii. By applying viscous damper to the structure there is reduction of about 60% to 80% in drift value at top and bottom stories.

ix. The base shear value of bare frame model is 1291.18 kN and that to model with viscous damper is 1487.82kN.

x. By observing the shear value, the difference is less because of the weight of the damper provided to the structure.

xi. From the study, by applying viscous dampers to the structure its behaviour change under seismic loading.

xii. By observing, these viscous damper devices perform a vital role in reducing and controlling the seismic response of the structure.

[2.5] Jigar C. Mehta[1], N. G. Gore[2], V. G. Sayagavi[3] and P. J. Salunke[4] [2018]

The main aim of the study is to find the optimum system for better seismic performance of a structure installed with dampers.

Based on the analysis results obtained following conclusion are made:

1) While considering the storey displacement in RCC structure with beam column frame model R9(i.e dampers provided in 3rd,4th and 5th floor) shows 17.3% and 22.9% reduction of displacement in X and Y direction respectively. The displacement goes on increasing to 24.8% for model R2 and 4.9% for model R3 in X direction while 11.7% increase for model R2 and 4.8% increase for model R3. This shows that the dampers are effective in reducing the displacement when provided in bottom storey and goes on increasing as we provide it in the top storey.

2) The storey drift of the structure is reduced by 59.6% in X-direction and 71% in Y direction when dampers are provided in 3rd, 4th and 5th floor in RCC structure with beam column frame. While the storey drift is increased by 120.6% and 176% in X and Y direction respectively when dampers are provided in all storey. Hence the reduction of storey drift is achieved by installing dampers in the bottom storey.

3) There is increment in base shear by 3.83% when dampers are provided in the bottom storey while there is 13.14% and 25.87 % reduction in X and Y direction respectively when dampers are provided in all storey. The structure is becoming flexible when we provide dampers in all storeys thereby reducing the base shear. Whereas there is just 3.8% increase in base shear when damper is provided at bottom storey only.

4) The time period of the structure in the first mode is reduced by 7.9% when dampers are provided in 3rd, 4th and 5th floor. Thus by introduction of dampers in bottom storey time period of the structure can also be reduced.

5) From the above analytical results it is clear that providing dampers in bottom storey are beneficial for reducing storey displacement, storey drift and time period of the structure.

[2.6] Vibha More[1], Dr. Vikram Patil[2] Takkalaki[3] [2019]

Based on the results and discussion the following conclusions are made.

i. Up to 44% reduction in storey displacement was observed when Fluid Viscous Damper are provided till 10th floor in zigzag pattern while, reduction is up to 54% when Fluid Viscous Damper are provided in all external corner in zigzag pattern.

ii. The storey drift decreased up to 78% when FVD are provided till 10th floor in zigzag pattern. Also, it decreases up to 65% when FVD are provided in all external corners in zigzag pattern.

iii. Around 40% reduction in time period was observed when FVD are used.

iv. It is observed that, model B with aspect ratio 1 with dampers provided in zigzag pattern in all external corners gives satisfactory result as compared with other models.

v. Model D with aspect ratio 1.5 with dampers provided in zigzag pattern in all external corners also gives good result.

3. CONCLUSIONS

After Study all paper which are given in the literature review, following conclusion are come out:

i. The value of the torsion decrees which is arising in the L shaped building and value of the torsion in the L shape building is less as compared to the T shaped building.

ii. By using the viscous damper we found that the value of the base shear, storey displacement is decrease as compared to the normal building.

iii. By using the viscous damper, reduction in the base shears, storey drift with increasing the number of the floor.

iv. The time period is also found to be reduced as compared to that of bare frame with the addition of dampers about the 25%. The bending moments in beams, axial forces in columns are greatly reduced with the addition of dampers.

REFERENCES

[1] X.L. Lu, K. Ding & D.G. Weng "Comparative Study on Seismic Behavior of RC Frame Structure Using Viscous Dampers, Steel Dampers and Viscoelastic Dampers" 2012.

[2] Benita Merlin Isabella "Seismic Performance Analysis of RCC Benchmark Problem with Passive Control System" International Journal of Scientific & Engineering Research Volume 8, Issue 6, June-2017.

[3] Rakesh Patwa[1], Dr. Savita Maru[2] "Comparative Study of Seismic Analysis of Dampers in Asymmetrical R.C. Frame Building" International Journal for Research in Applied Science & Engineering Technology (IJRASET) *ISSN: 2321-9653; IC Value: 45.98; Volume 6 Issue VIII, August 2018.*

[4] Jigar C. Mehta[1], N. G. Gore[2] "Seismic Response Evaluation of a RC Structure with Embedded Passive Dampers" International Journal of Science Technology & Engineering | Volume 5 | Issue 4 | October 2018.

[5] Vibha More, Dr. Vikram Patil, "Dynamic Analysis of RCC Frame Structures with and Without Viscous Damper Having Different Aspect Ratio" IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 6 Issue 10 October 2019.

[6] Shruti S. Mane[1], Dr. Y. M. Ghugal[2] "Seismic Analysis of Asymmetric RCC Buildings using Passive Energy Dissipating Devices" in IRJET, 2019.