Analysis of Multi-storey RC Building with and without Seismic damper at different position

Hardik Patel[1], Bijal Chaudhri[2], Maulik Kakadiya[3]
Department of Civil Engineering
Uka Tarsadia University, Bardoli, Surat, India
***Corresponding Authors' email id**: hapatel424@gmail.com[1], bijalchaudhri93@gmail.com[2], maulikkakadiya222@gmail.com[3]*

Abstract

In modern seismic design, damping devices are used to reduce the seismic energy and enable the control of the structural response of the structure to that earthquake excitation. The research work is concerned with the comparison of the seismic evaluation of RC buildings connected with and without Viscous and Friction dampers. Response spectrum and seismic co-efficient method is used to analyse seismic behaviour of G+10 story building with and without dampers. In response spectrum method, earthquake load is applied in both the horizontal direction. For the analysis purpose ETABS 2016 software is used by considering seismic zone-v as per IS 1893:2002(part I) code. The linear response spectrum analysis and seismic co-efficient analysis were carried out and the result obtained from the model compared in terms of storey displacement in X direction and Y direction and best alternative for construction in earthquake-prone area was selected.

Keywords: *Multi-storey building, earthquake, viscous damper, friction damper, displacement, Response spectrum, seismic co-efficient, ETABS.*

I. INTRODUCTION

Damper is a device mounted in structures to reduce the amplitude of vibrations.

1. Fluid Viscous Damper

Fluid viscous damping is a way to add energy dissipation to the lateral system of a building structure. A fluid viscous damper dissipates energy by pushing fluid through an orifice, producing a damping pressure which creates a force. These damping forces are 90 degrees out of phase with the displacement driven forces in the structure. This means that the damping force does not significantly increase the seismic loads for a comparable degree of structural deformation.

The addition of fluid viscous dampers to a structure can provide damping as high as 30% of critical, and sometimes even more. This provides a significant decrease in earthquake excitation. The addition of fluid dampers to a structure can reduce horizontal floor accelerations and lateral deformations by 50% and sometimes more.

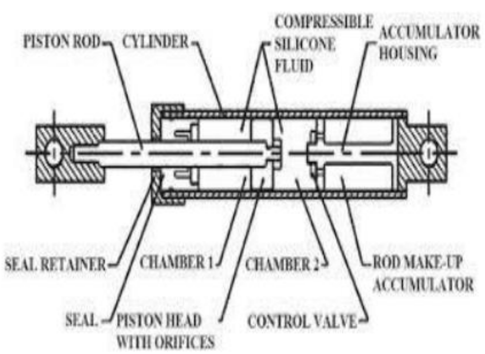

Fig 1: Elements of fluid viscous damper

2. Friction Damper

The unique and patented friction damper device consists of several steel plates rotating against each other in opposite directions. The steel plates are separated by several shims of friction pad material producing friction with the steel plates.

V-Bracing, Diagonal Bracing, Toggle Bracing and Panel Wall Dampers

The Multi Unit Friction Dampers are based on a rotational friction concept like all Damp tech dampers. The dampers can be installed, for example, in frame structures as V-Bracing, Diagonal Bracing, or Panel Dampers. The dampers are connected to the structure with pin connections on both sides.

OBJECTIVES AND NEED OF THE STUDY

- To carry out analysis of earthquake impacts on G+10 multistory RC building using ETABS 2016 structural software.
- Analysis of RC building with seismic co-efficient analysis and response spectrum analysis
- To analyze the structure using equivalent static method and response spectrum method according to is 1893: 2002.

- To compare parameters like displacement in both the horizontal direction, base shear, story drift and time period under seismic loading.

- Minimum damage of multi-story RC building during earthquake, To get this requirement, building must achieved proper strength, stiffness and ductile

- To understand behaviour of RC building during and after earthquake

- Find out optimum solution of earthquake resistance RC building by considering of required performance level.

METHODOLOGY

These research works is concerned with the comparison of the seismic evaluation of RC buildings connected with and without Viscous and Friction dampers.

Response spectrum and seismic co-efficient method is used to analyse seismic behaviour of G+10 story building with and without dampers. In response spectrum method, earthquake load is applied in both the horizontal direction. For the analysis purpose ETABS 2016 software is used by considering seismic zone-v as per IS 1893:2002(part I) code.

Types of model in ETABS software:

Model 1: G+10 R.C. Building without Seismic Dampers

Model 2: G+10 R.C. Building with Fluid Viscous Dampers at Corners.

Model 3: G+10 R.C. Building with Fluid Viscous Dampers without corner position

Model 4: G+10 R.C. Building with Fluid Viscous Dampers At all External Joints

Model 5: G+10 R.C. Building with Friction Dampers at Corner Position.

Model 6: G+10 R.C Building with Friction Dampers without Corner Position.

Model 7: G+10 R.C. Building with Friction Dampers with all External Joints

MANTECH Publications

International Journal of Advance Civil Engineering and Technology
Volume 3, Issue 1, January-June, 2018

Effects of Earthquake on G+10 MultiStory RC Building In Seismic Zone-Iv, Medium Soil Condition Without Dampers

Table 1: Data for G+10 R.C. Building without seismic Dampers

Data for Building	Dimensions
Plan Dimension	20m × 20m
Typical Story Height	3m
Bottom story height	4m
Slab Thickness	150mm, M20
Column size	230mm × 450mm, M25
Beam size	230mm × 350mm, M20
Floor finish	0.8KN/mm^2
Water proofing	1.5KN/mm^2
Earthquake data	Zone-IV, Type-I medium soil and Importance Factor 1.5
wall thickness	Internal wall thickness = 115mm External wall thickness = 230mm
live load	4 KN/mm^2
Rebar	HYSD 500

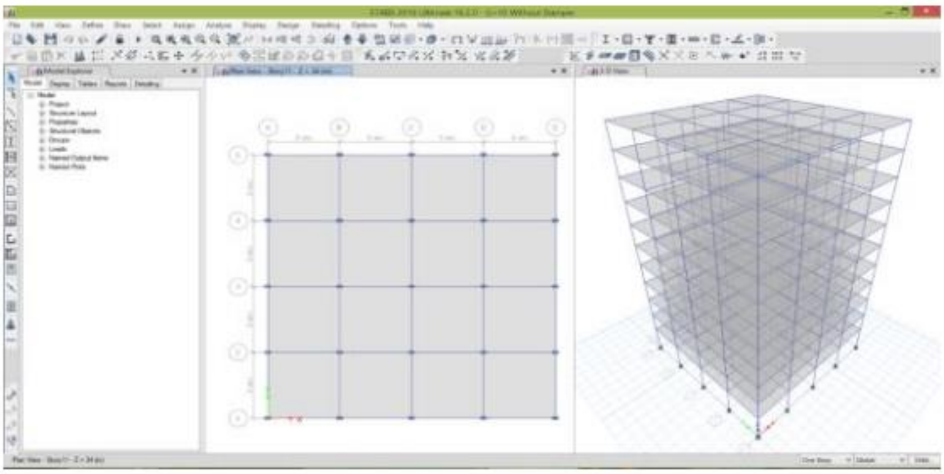

Figure 2 G+10 Multi-storey R.C. Building without seismic Dampers

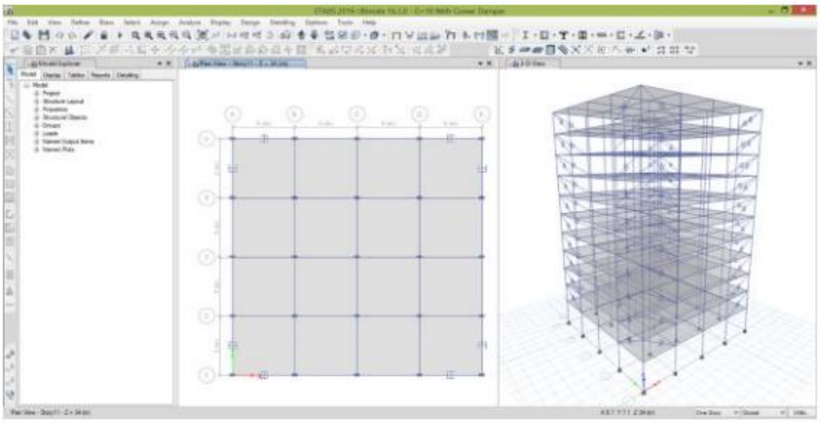

Figure 3 G+10 Multi-storey R.C. Building with FVD at Corners

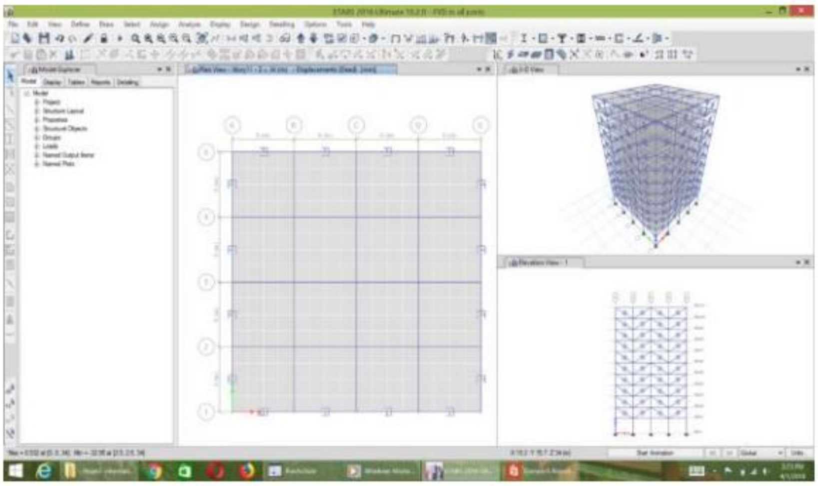

Figure 4 G+10 Multi-storey R.C. Building with FVD at All Joints

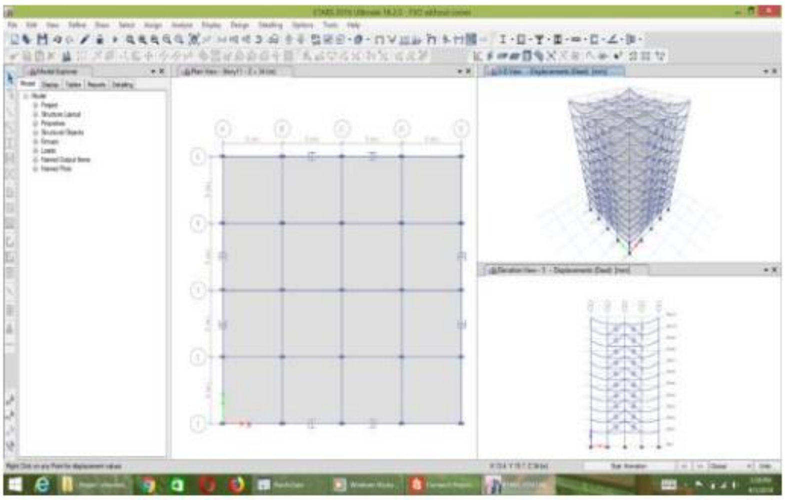

Figure 5 G+10 Multi-storey R.C. Building with FVD without Corner Position

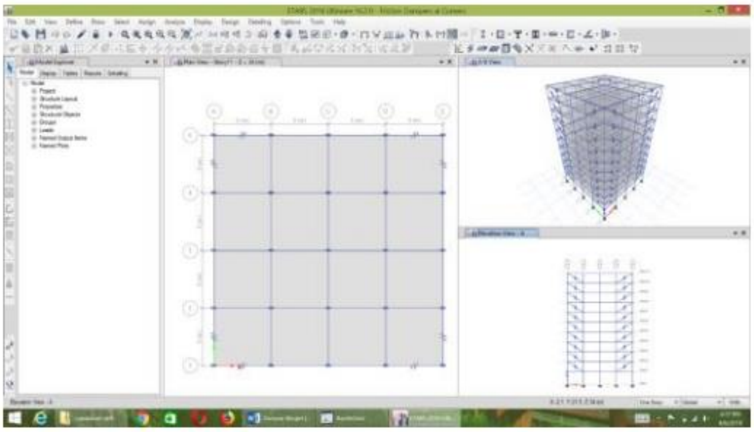

Figure 6 G+10 Multi-storey R.C. Building with Friction Dampers with Corner Position

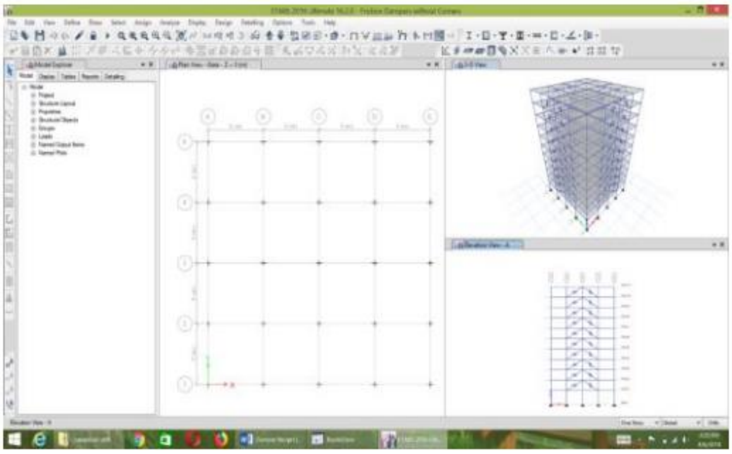

Figure 7 G+10 Multi-storey R.C. Building with Friction Dampers without Corner Position

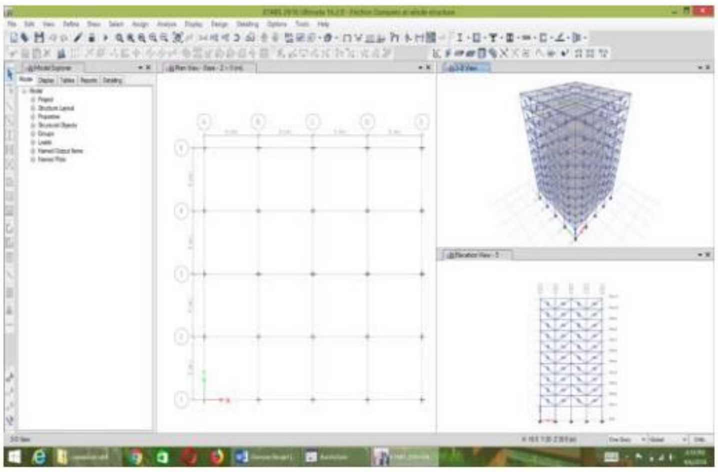

Figure 8 G+10 Multi-storey R.C. Building with Friction Dampers at All External Joints

RESULTS AND DISCUSSION

Displacement Analysis of G+10 R.C. Building with and without Seismic Dampers

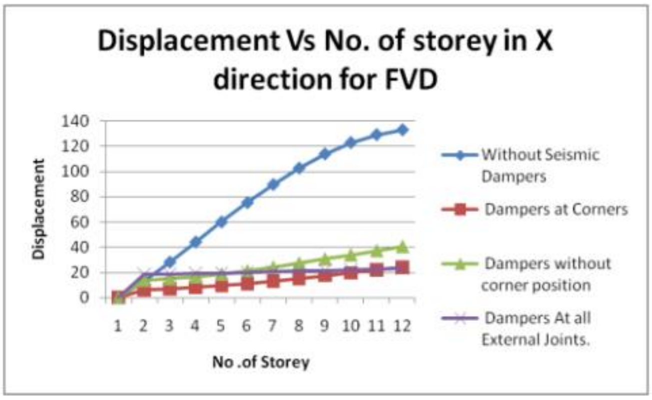

Chart 1: Displacement Vs No. of storey in X direction for FVD

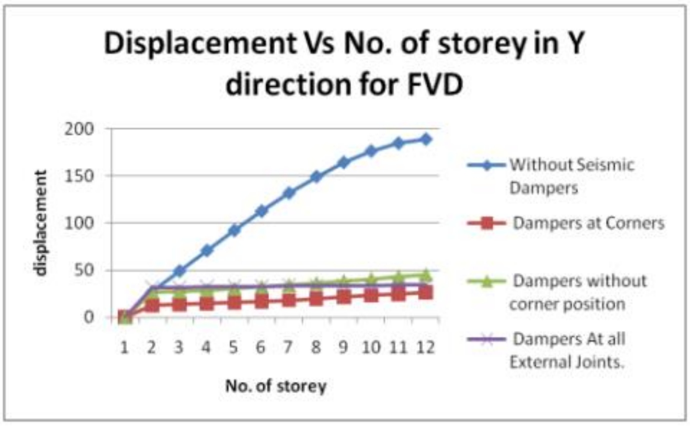

Chart 2: Displacement Vs No. of storey in Y direction for FVD

As shown in graph if we use fluid viscous damper in building at different position. displacement will be reduce in X direction and Y direction

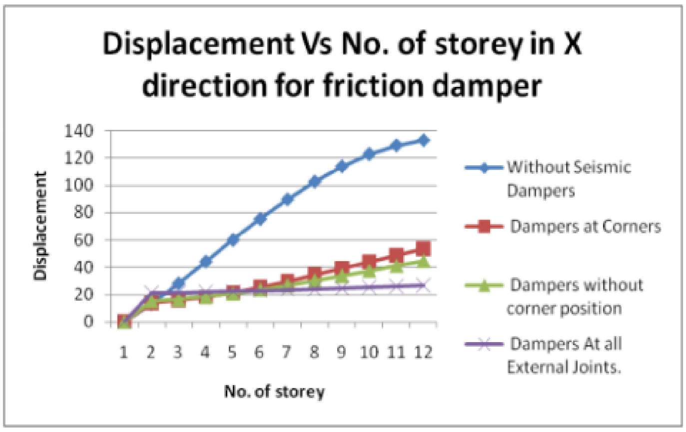

Chart 3: Displacement Vs No. of storey in X direction for friction damper

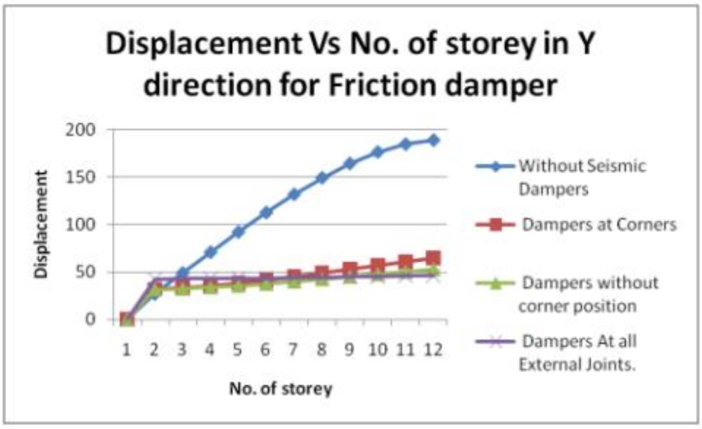

Chart 4: Displacement Vs No. of storey in Y direction for friction damper

As shown in graph if we use friction damper in building at different position. displacement will be reduce in X direction and Y direction.

CONCLUSION

- Comparison between the regular building the storey displacement in X direction and Y direction decreases for the buildings having fluid viscous dampers.
- Comparison to the regular building the storey displacement in X direction and Y direction decreases for the buildings having friction Damper.
- Although there are some differences in energy dissipation principle and mechanical properties, all the two types of dampers show excellent damping effect and reduce displacement in multistorey building.

REFERENCES

I. Anita Tippanagoudar, Dr. J G kori & Dr. D K kulkarni,"Performance analysis of high rise building with viscous damper", IJATER Volume 2, Issue 4, July 2015.

II. Dipak Patel, Vishal B Patel & Anshu Arya," Energy dissipation system in multistory building using viscous damper", Volume 4, issue 6, June 2017.

III. M. S. Landge & Prof. P. K. Joshi," Seismic performance evaluation of RC building connected with and without viscous damper", M.E. Scholar, Associate Professor, Civil Eng., PVPIT (India). IJARSET Volume 5 Issue 3, March 2017, ISSN: 2321-9653.

IV. S. S. Pathan, D. N. Kakade & A. P. Wadekar, "Seismic response control of asymmetric building using friction damper and shear wall". Journal of structural technology volume 2, Issue 2, 2017.

V. Saman Musician, Amir B. Hami, Hamid Masaeli and Faraamarz Khoshncudian, "Effects of Friction Damperbrace Design Parameters on seismic Performance of Multistory Building Structures", Research Journal of Environmental and Earth Science 6(5): 299-306, 2014, ISSN: 2041-0484; e-ISSN: 2041-0492, 20 May, 2014.

