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A Comparative Study on Seismic Analysis of Multistorey RC Building Connected with Different Dampers and Without Dampers

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Abstract: Due to growing in huge population and hasty urbanization, in modern era high rise building construction is increasing more than ancient days, high rise buildings are basically subjected to lateral loads or forces such as wind load and earthquake loads, seismic damper is the one of the device used to reduce storey responses in high rise building era,the work is made to comparative study on seismic behavior of multi storey rc building connected without and with dampers G+15 building of regular building plan of 34 m X 24 m is considered for analysis ETABS software is used for modeling and analysis of structure, the comparison made on storey responses like storey displacement, storey drift, storey shear, modal time period and frequency
Keywords: Friction damper, Viscous damper, storey displacement, storey drift, storey shear, modal frequency and time period

I. INTRODUCTION

Earthquake is one of the life-threatening and dangerous natural disasters that can occur anytime and anywhere on earth. Most earthquakes come with minor tremors but bigger earthquakes with heavy tremors usually start with slight tremors but quickly become more violent shocks. Stronger earthquakes usually end up with enormous and compelled vibrations at long distance from the primary arousal point. With decreased aftershocks it gradually decreases. Earthquakes focus becomes the underground point of origin. Earthquake magnitude and intensity can be measured using various scales such as Richter scale, moment magnitude scale, modified Mercalli scale, etc.

Dampers are made and developed to prevent structural failure, to protect integrity of structure, and to prevent life of residents by absorbing vibration or energy caused by earthquake and reducing deformation in the high rise building Seismic dampers allows the building to resist severe cause input energy and prevent harmful forces, deformation, displacement, and accelerations there are different types of dampers namely friction damper, fluid viscous damper, magnetic damper, yielding damper, and tuned mass damper

II. FRICTION DAMPER

Friction damper generally consists of many steel plate which is sliding against one another in opposite directions.the plates are separated by a thin material of friction pad.the damper disappears energy by means of sliding between the surfaces which are sliding against each other

Fig1: Friction Damper

III. FLUID VISCOUS DAMPER

Another type of damper is fluid viscous damper ,the damper consists of silicone based fluid which absorbs seismic energy by passing between piston cylinder arrangement the damper used in high rise structures in seismic areas .it can be active in an temperature ranging between 40oc-70oc.this damper prevent the vibrations caused by both strong wind and earthquake

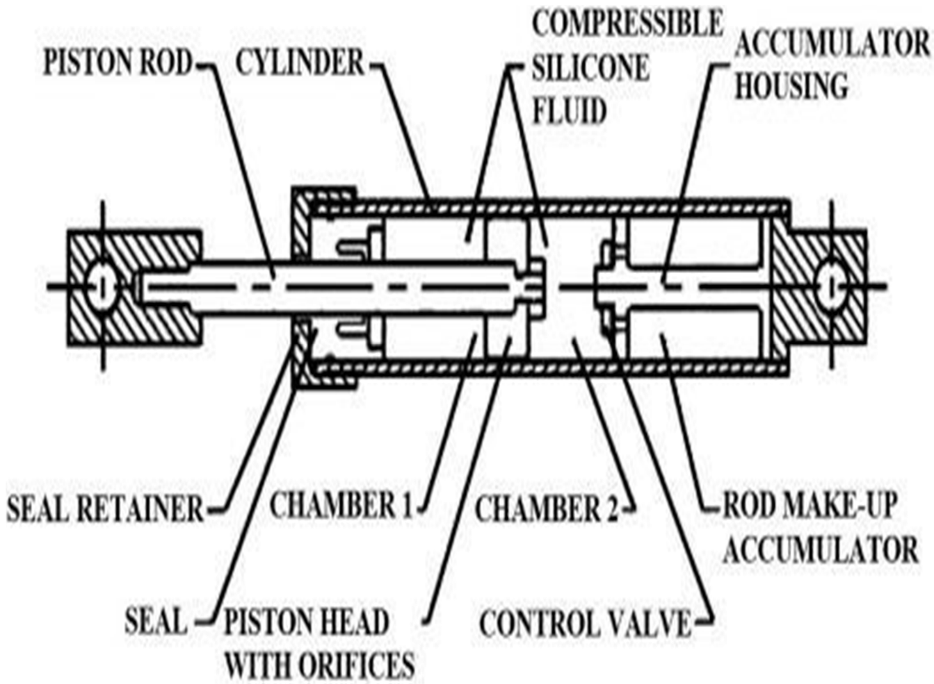

Fig2;Fluid Viscous Damper

IV. OBJECTIVES

The main aim of this projects to comparative the seismic behaviour of RC UnDamped structure with Damped structures as per Indian Standard code. Specific objectives below

1) Modelling of RC Un Damped structure and Damped structure(Friction and viscous) of G+15 storey in zone v by using ETABS software.
2) To made seismic analysis on the models and the effect of earthquake ground motions on these structures are studied
3) To analyse these model by response spectrum analysis and know the structural integrity, performance of buildings.
4) To carry out comparison between RC Undamped and Damped structure on the basis of their dynamic properties such as storey displacement, storey drift ,base shear, time period, and naturalfrequency

V. METHODOLOGY

1) Literature study (searching codes, methods and techniques)
2) Definiing objectives of the study
a) Model generation using etabs
b) Applying link(dampers)
c) Applying loads and seismic parameters as consider for this study
d) Analysis of building models to obtain the results
e) Comparision of the results and concluding the work with conclusions

VI. MODELLING

The 16-storey building is having 34m x 24m plan dimension and 48m total height of building. The storey height is 3m. The typical plan and elevation are shown in figure 1. There are three models for comparative study, one is for RC undamped structure and another two is for damped(friction and viscous) structure.

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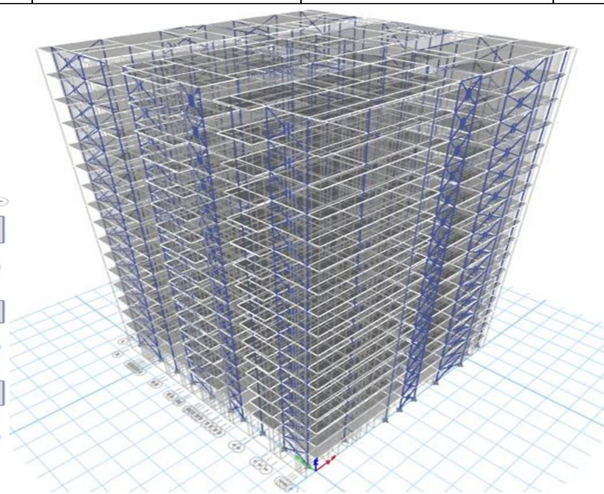
TABLE I

Building considerations	Details
Purpose of building	Residential building
Number of storeys	G+15
Plot dimension	34mx24m
Floor-floor height	3.m
Thickness of slab	150mm
Size of column	2300x600mm
Size of beam	2300x600mm
Live load	3 kN/m^2
floor load	1.5kN/m^2
Grade of concrete	M 30
Grade of steel	Fe 415
Wind speed	44m/s
Type of structure	Special moment resisting frame
Seismic zones	V
Soil type	Soft soil
Importance factor	1.2
Response reduction factor	5
Daming ratio	5%
Load combinations	1.2(DL+LL+RSX) 1.2(DL+LL+RSY) 1.2(DD+LL)

TABLE 2 DAMPING PROPERTY

DAMPER PROPERTY	MASS(kg)	WEIGHT(Kn)	EFFECTIVE STIFFNESS(Kn/m)	EFFECTIVE DAMPING(kN-S/m)	DAMPING TYPE
FRICTION DAMPER	2200	0.225	20000	4000	EXPONENTIAL
VISCOUS DAMPER	1700	0.173	20000	1000	BILINEAR

Fig;3 Building Plan



Fig;4 Building 3D Model with Dampers

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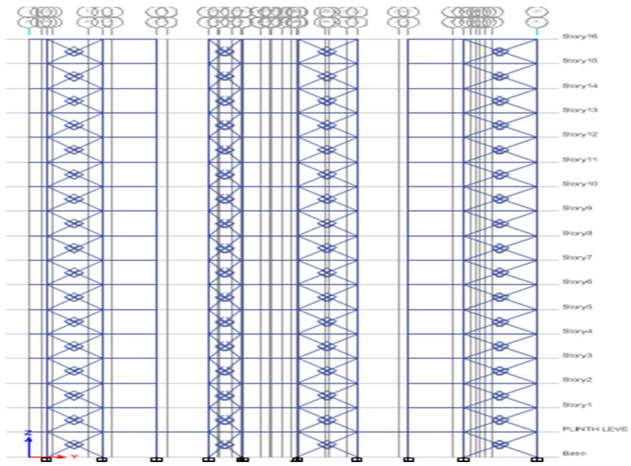

Fig;5 Damped Building Elevation

VII. RESULTS AND CONCLUSION

Model is done with the all the Specified loads as per the code and the analysis of is done with response spectrum method from analysis various storey responses are compared and conclude made on results obtained .it includes storey displacement, storey drifts storey shear, modal time and frequency

A. *Storey Displacement*

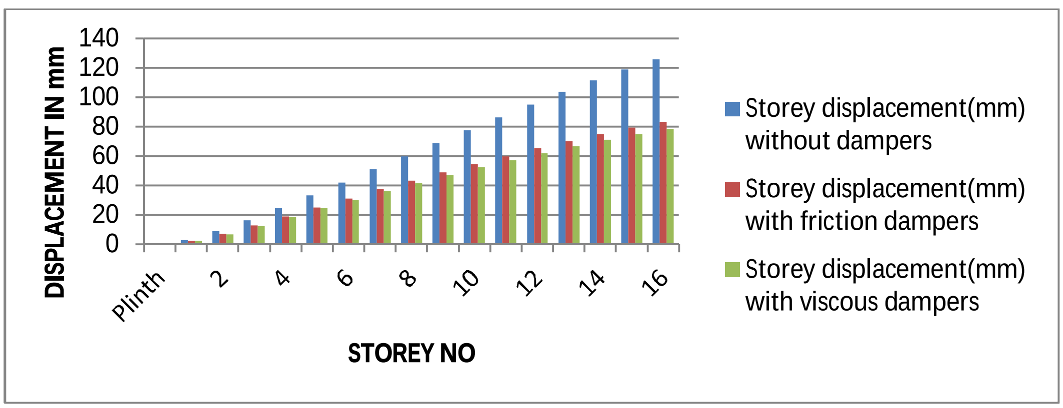

Fig 6:Storey Displacement plot of undamped Structures vs damped structures

B. *Storey Drift*

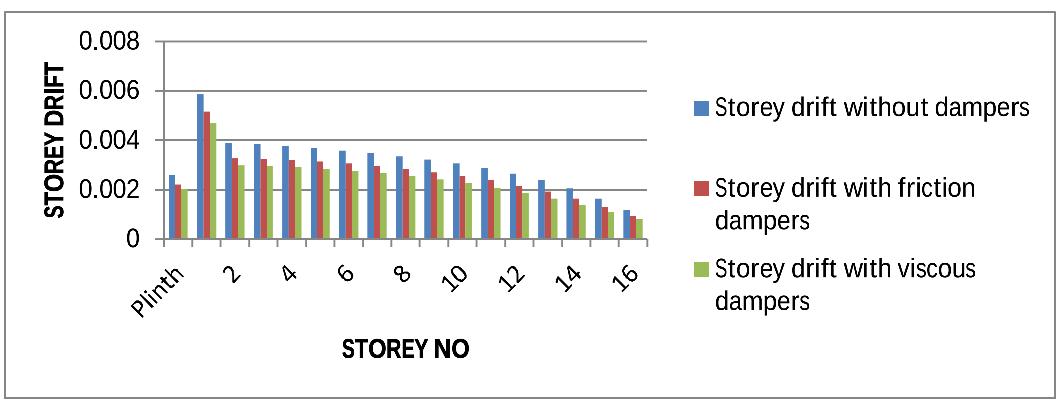

Fig 7:Storey Drift plot of undamped Structures vs damped structures

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C. *Storey Shear*

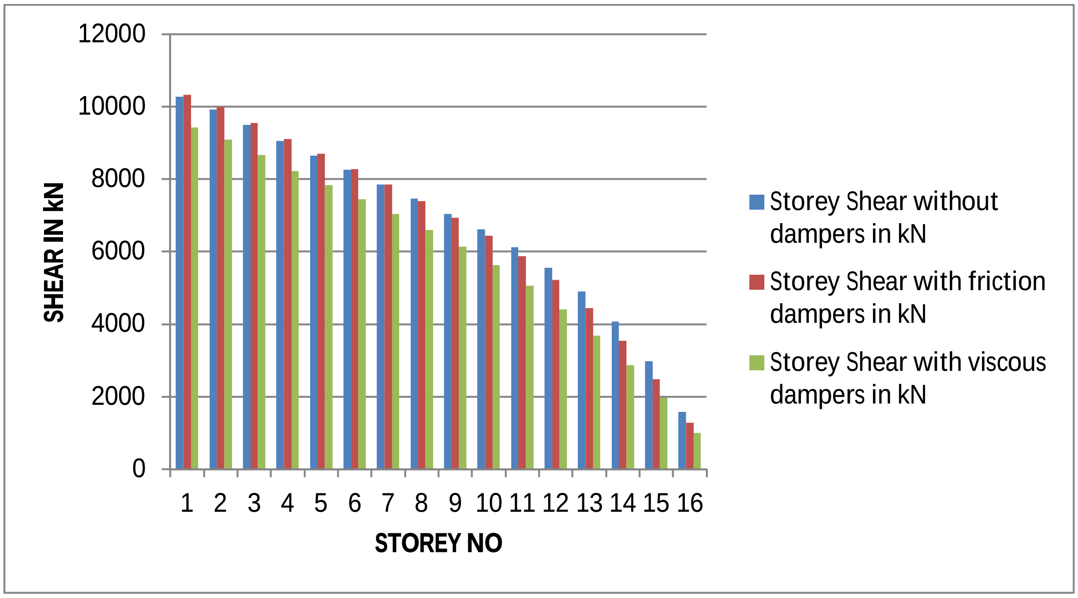

Fig 8:Storey shear plot of undamped Structures vs damped structures

D. *Time Period*

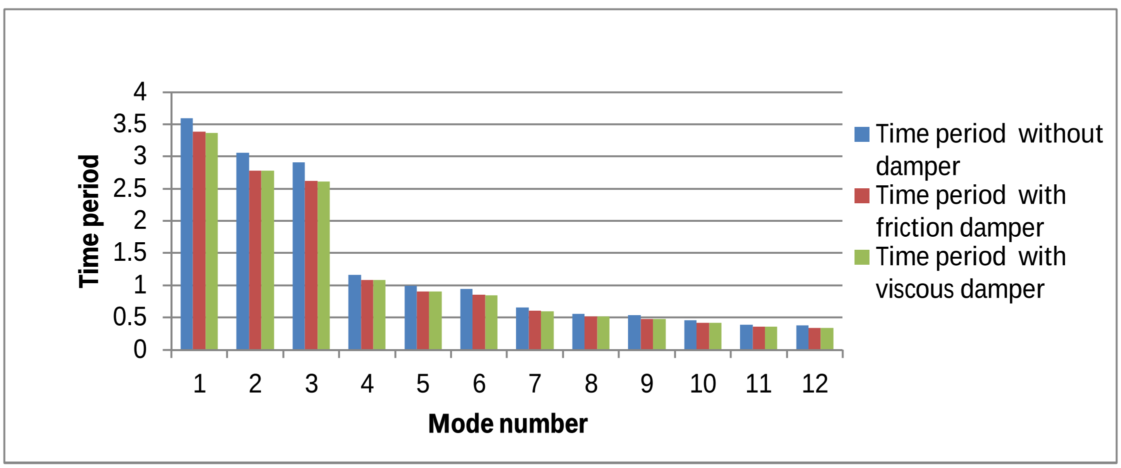

Fig 9:Time Period plot of undamped Structures vs damped structures

E. *Frequency*

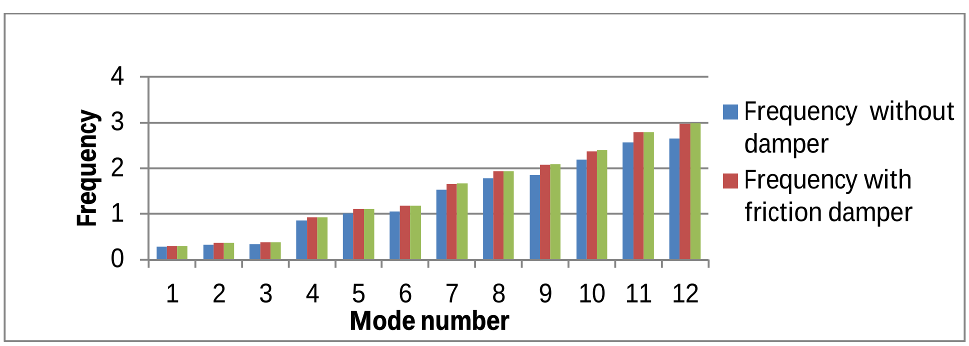

Fig 10:Frequency plot of undamped Structures vs damped structures

VIII. CONCLUSIONS

1) Storey Displacement is the most important storey response that get reduced after damping to the model,.for a G+15 storey building with and without dampers(Friction and Fluid viscous damper) the displacement value obtained for response spectrum method along x and y direction
2) Storey displacement for undamped structure is max when compared with damped structure
3) From above it is cleared that displacement value is least in viscous damper as compared to model without damper by 38% and model with friction damper by 6%
4) Storey drift is max at storey 1 and decreases gradually in upper storey's
5) Storey drift in model without damper is max when compared model with dampers
6) From above it is cleared that drift value is least in viscous damper as compared to model without damper by 29.82% and model with friction damper by 13%
7) The storey shear is decreased in upper storey in damper connected model than in without damper model it is decreased by 19% in case of friction damper and 36% in case of viscous damper
8) The viscous damper reduce storey shear by 21% compared to friction damper
9) Time period for undamped building is more as compared to damped building
10) As we know The time period is inversely proportional to frequency so natural frequency of both damped structure is more compared to undamped structure
11) Here frequency of the damped structure increases so the stiffness is also increases as stiffness is directly proportional to frequency
12) From above it is cleared that time period is least in viscous damper as compared to model without damper by 6% and model with friction damper by 0.7%
13) From above it is cleared that frequency of viscous damper is more as compared to model without damper by 6% and model with friction damper by 0.7%
14) From the above it can be concluded that viscous damping devices play a vital role in reducing and controlling the seismic response of the structure compared to other type

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