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Seismic Analysis of Tall Structures by using Dampers in Etabs

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Abstract:- In this paper the investigation was carried on earthquake resistance structure made by adopting the dampers for different storied building with bay size of 5 X 5 m and storey height of 3m using E-tabs software. Study is carried with and without the building analysis is carried by response spectrum method by using Etabs 2016 software. The parameters are studied are Base shear, storey stiffness, lateral drift, time period and effectiveness of damper.

Keywords:- *Displacement, Storey shear, lateral stiffness, storey drift and modal time period.*

I. INTRODUCTION

Power dissipation devices and the basis for isolating the most common compo-nents of idle control systems. Over the past two decades, a wide range of dynamic tools such as metallic dampers, friction dampers, visco-elastic dampers, and fluid viscous dampers have been developed. The published literature contains a de-tailed examination of the dynamic energy dissipation systems and applications (Soong and Dargush, 1997) .The installation of energy-absorbing devices in the building system reduces excessive flexibility and ductility while increasing pow-er dissipation. Energy-capture devices have been shown to work well for both short-term (shock loads) and long-term loads (earthquake power or wind loads).

If the absorption capacity of a building exceeds seismic capacity, it can with-stand structural damage. Equal viscous damping is an effective way to reduce structural failure

Dampers are classified according to their performance of collision, metal (flowing), viscous, viscoelastic, Shape memory alloys (SMA) and large dampers. The benefits of hiring dampers include high power absorption, ease of installa-tion and replacement, and integration with other construction elements.

II. OBJECTIVES

- To study the impact of rigidity associated with the behavior of water frames in different earthquake zones.
- Compare your contribution of both dampers with side power and side strength of multi-storey structures.
- Comparing the behavior of building structures due to the presence of dampers in different earthquake zones.
- To get the development of dampers in the building. Therefore, it provides a significant reduction in structural response.
- Modeling and analyzing a consistent base with different types of heat-reducing structures using ETABS 16.1 version software and studying the effect of seismic forces on these models.
- Comparative study of different types of dampers and their parameters such as floor shear, storey drift, durability, base shear and complete removal.

III. METHODOLOGY

The structural analysis is carried for both concrete and steel structure during earthquake. An ordinary moment resisting building of 10, 15, and 20 storey concrete and steel structure located over medium soil. Different types of dampers are used and analysis is done using the Etabs software.

The various building models considered are
Model – 01 Bare frame structure of 10 storey in zone II
Model – 02 Viscous damper structure of 10 storey in zone II
Model – 03 Friction damper structure of 10 storey in zone II
Model – 04 Bare frame structure of 15 storey in zone II
Model – 05 Viscous damper structure of 15 storey in zone II
Model – 06 Friction damper structure of 15 storey in zone II
Model – 07 Bare frame structure of 20 storey in zone II
Model – 08 Viscous damper structure of 20 storey in zone II
Model – 09 Friction damper structure of 20 storey in zone II
Model – 10 Bare frame structure of 10 storey in zone V
Model – 11 Viscous damper structure of 10 storey in zone V
Model – 12 Friction damper structure of 10 storey in zone V
Model – 13 Bare frame structure of 15 storey in zone V
Model – 14 Viscous damper structure of 15 storey in zone V
Model – 15 Friction damper structure of 15 storey in zone V
Model – 16 Bare frame structure of 20 storey in zone V
Model – 17 Viscous damper structure of 20 storey in zone V
Model – 18 Friction damper structure of 20 storey in zone V
The models considered are as shown in the Fig 1 and Fig 2.

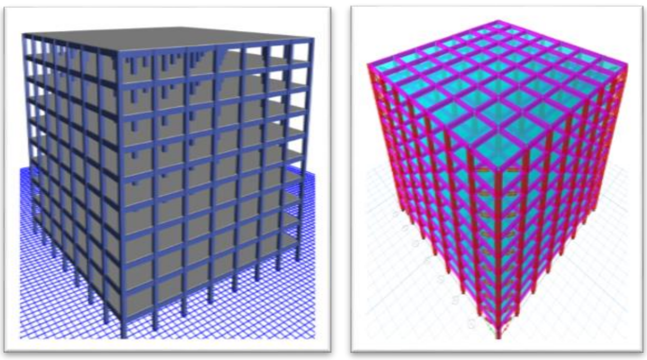

Fig.1: Bare frame structure and Viscous damper structure

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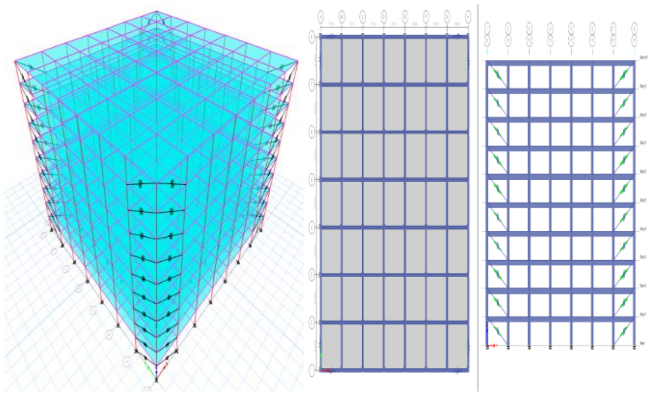

Fig. 2: Friction damper structure

IV. RESULTS AND DISCUSSION

The structural analysis is carried for both concrete and steel structure during earthquake. An ordinary moment resisting building of 10, 15, and 20 storey con-crete and steel structure located over medium soil. Different types of dampers are used and analysis is done using the Etabs software.

A. Story Dusplacement

Table 1 and Fig 3 shows the story displacement obtained for the considered models. The viscous damper shows a smaller migration compared to the other two models. The displacement is minimum on the lower floors and gradually increases in height on the upper floors. However the height of the building rises and the dis-placement also continues to rise because the small migration to the 10-story building and the large migration to the 20-storey building. Subtraction is minimal in zone ii and higher in zone v respectively near x and y.

The shift in the steel structure shows very little compared to the rcc structure, in the steel structure all the performance of the structure is the same in both places and in both directions respectively.

DISPLACEMENT 20 STORIES IN ZONE V ALONG X DIR.			
Storey Level	**BARE FRAME**	**VISCOUSE DAMPER**	**FRICTION DAMPER**
20	85.409	74.626	76.224
19	84.301	71.672	73.921
18	82.587	68.546	71.228
17	80.262	65.19	68.215
16	77.379	61.567	64.879
15	74	57.668	61.231
14	70.185	53.499	57.294
13	65.991	49.085	53.1
12	61.474	44.46	48.687
11	56.682	39.668	44.097
10	51.664	34.762	39.377
9	46.463	29.802	34.579
8	41.118	24.861	29.759
7	35.665	20.019	24.978
6	30.137	15.373	20.302
5	24.563	11.035	15.808
4	18.97	7.142	11.581
3	13.396	3.858	7.722
2	7.927	1.391	4.351
1	2.916	1.076	1.609
0	0	0	0

TABLE 1 DISPLACEMENT IN MILLIMETERS ALONG X DIRECTION FOR ZONE 5

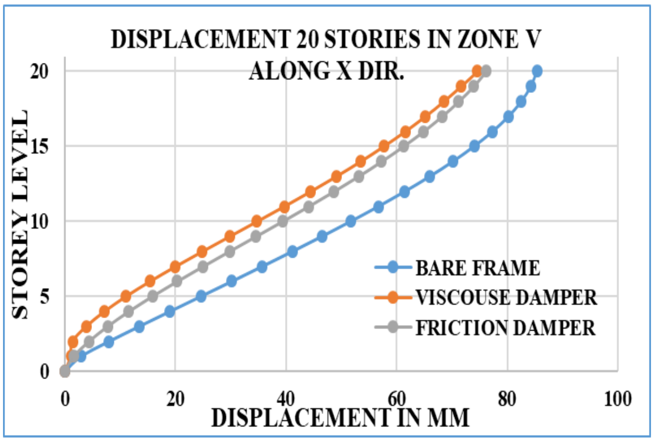

Fig. 3: Displacement in millimetres along x direction for zone v

B. Story Drift

Table 2 and Fig 4 shows the story displacement obtained for the considered models. The viscous damper shows less drift compared to the hollow frame and friction damper. The Drift is very high in the lower floors and gradually rises to a certain level and suddenly descends to the upper floors in all the models considered in the study on both side x and y respectively. However the height of the building increases the erosion and also increases. The floor level of all the considered models is within the permissible limit.

The drift in steel structure appears to be very small compared to the rcc structure, in the steel structure all the performance of the structure is the same in both places and in both directions respectively.

DRIFT 20 STORIES IN ZONE V ALONG Y DIR.			
Storey Level	BARE FRAME	VISCOUSE DAMPER	FRICTION DAMPER
20	0.000369	0.000985	0.000614
19	0.000571	0.001042	0.000718
18	0.000775	0.001119	0.000803
17	0.000961	0.001208	0.00089
16	0.001126	0.0013	0.000973
15	0.001272	0.001389	0.00105
14	0.001398	0.001471	0.001118
13	0.001506	0.001542	0.001177
12	0.001597	0.001597	0.001224
11	0.001673	0.001636	0.001259
10	0.001734	0.001653	0.001279
9	0.001782	0.001647	0.001285
8	0.001818	0.001614	0.001275
7	0.001843	0.001549	0.001247
6	0.001858	0.001446	0.001198
5	0.001864	0.001298	0.001127
4	0.001858	0.001094	0.001029
3	0.001823	0.000822	0.000899
2	0.00167	0.000464	0.000731
1	0.000972	0.000106	0.000429
0	0	0	0

TABLE 2 STORY DRIFT IN MILLIMETERS ALONG X DIRECTION FOR ZONE 5

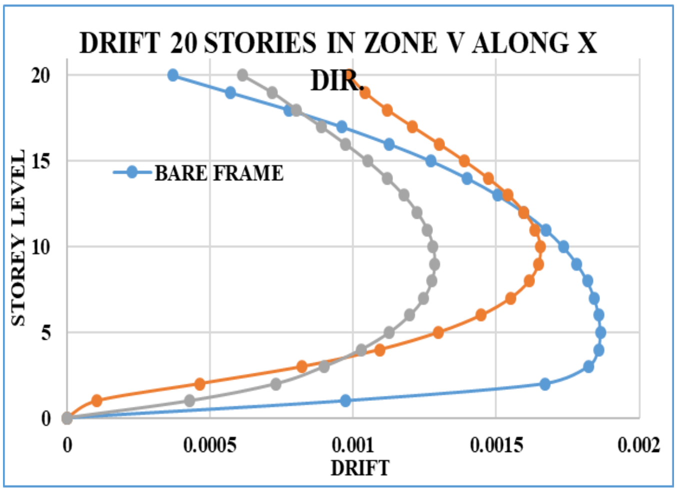

Fig. 4: Story Drift in millimetres along x direction for zone v

C. Base Shear

Table 3 and Fig 5 shows the story displacement obtained for the considered models. The base shear of the viscous damper is small compared to each other in the mod-els and the empty frame structures show the shear base for both sinners and indi-cators both x and y respectively.

BASE SHEAR 20 STORIES IN ZONE V ALONG Y DIR.			
EQY	**BARE FRAME**	**VISCOUSE DAMPER**	**FRICTION DAMPER**
	4400.6752	1208.3582	4403.8249

TABLE 3 BASE SHEAR IN KN ALONG X DIRECTION FOR ZONE 5

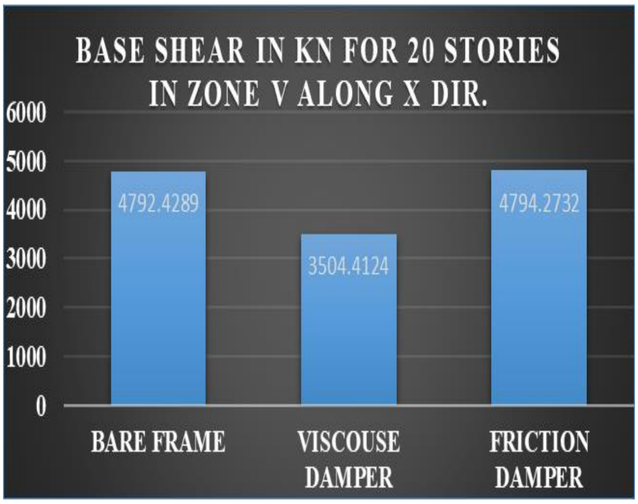

Fig. 5 Base Shear in KN along x direction for zone v

D. Modal Time Period

Table 4 and Fig 6 shows the story displacement obtained for the considered models. A bare frame structure offers a higher time compared to other structures. The viscous damper shows the minimum time between all models. We can conclude that when the height of a building increases with time and increases.

10 STOREYS PLAN IN ZONE V			
Modes	**BARE FRAME**	**VISCOUSE DAMPER**	**FRICTION DAMPER**
1	3.911	2.189	3.912
2	2.115	1.45	2.117
3	1.816	1.098	1.817
4	1.306	0.556	1.307
5	0.786	0.416	0.786
6	0.69	0.276	0.691
7	0.589	0.258	0.589
8	0.567	0.207	0.567
9	0.448	0.153	0.448
10	0.397	0.129	0.398
11	0.375	0.128	0.375
12	0.335	0.106	0.335

TABLE 4: TIME PERIOD IN SECONDS FOR ZONE 5

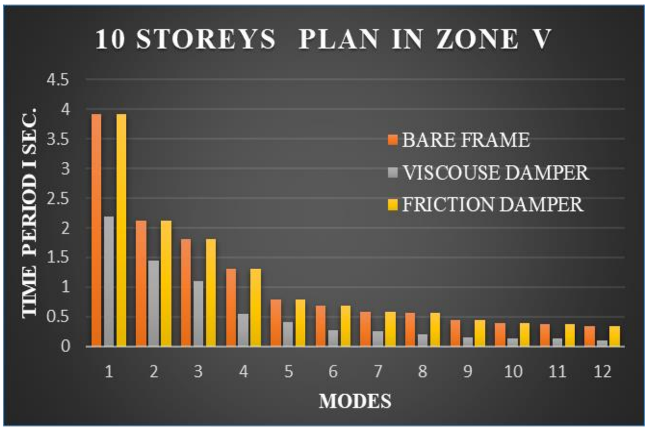

Fig. 6: Time Period in Seconds for zone v

V. CONCLUSION

This study demonstrates the resistance of an earthquake structure with multi-ple trunks connected to a variety of flexible and flexible dampers due to the ef-fects of the earthquake.

- Controlling vibration response to buildings is necessary to introduce addi-tional relaxation in buildings. Relief can be extended to a building by connecting dampers and stabilizing buildings during an earthquake.
- In the steel structure the displacement is 9.22% reduced compared to the rcc structure and the empty frame structure shows a removal of 12.36% above the viscous damper.
- The viscous damper is found to be very effective in controlling the vibration responses of connected structures.
- In the steel structure the slope is 10.25% reduced compared to the rcc struc-ture and the hollow frame shows a slope of 11.36% above the viscous damper.
- Subsequent migration caused by earthquake pressures is reduced by using viscos dampers instead of removing friction.
- In steel structure the floor strength is 13.02% increase compared to rcc structure and the empty frame structure shows floor strength less than 9.325% than viscous damper.
- Storey drift also reduces thus the shear resistance of the structure increases.
- In the steel structure the time is 25.35% shorter compared to the rcc struc-ture and the blank frame shows a maximum time of 52.36% than the viscous damper.
- By using viscos dampers instead of friction dampers, the base of the tower rises.
- In a comparable robust system with a reaction spectrum, the effectiveness of viscos dampers in controlling the movement of the sides and the erosion of the floor caused by the force of the earthquake is observed.

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