Study of Viscous Fluid Damper 6 Different Pattern on 12 Story Structure And Comparing Most, Mid and Least Effective Pattern on 17 Story Structure.

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ABSTRACT

Buildings in seismically active regions need to be constructed with special consideration for their lateral stability. With the development of India Infrastructure development coincides with India's economic growth. Many high-rise buildings are currently being built in Indian metropolises, but as building heights rise and wind pressure increases, more support structures are required to prevent displacement. Due to the terrible earthquake in Turkey, it is crucial for architects to take extra precautions to ensure the safety of both the expensive structures and the priceless lives they contain. In India, viscous fluid dampers are not frequently employed. Except for the north side near the India-China border, most of India is in zones II and III, which are not prone to earthquakes. Area on the south-west side of Goa. Even though the data is not so favourable, it is vital to take into account the probability of an earthquake occurring. We cannot overlook the calamity in Turkey, where a structure collapsed and hundreds of lives were lost. We will use viscous fluid dampers in the construction of this research. Numerous researches have already established the effectiveness of VFD in reducing the movement of structures under wind and seismic loads or earthquake forces. This paper focuses on evaluating different patterns on 12 story structure and contrasting their effectiveness on diverse structures and comparing its effectiveness of pattern on 17 story structure. This report employs response spectrum analysis to produce results that are more precise.

Keywords: Viscous Fluid Dampers, earthquake forces, Response Spectrum Analysis.

1-INTRODUCTION

Viscous Fluid dampers, or seismic dampers as they are likewise known, are devices that, when incited, disseminate the energy that seismic events, wind buffering, or warm movement force on a construction. The idea is straightforward: by dissipating the heat created by the structural movement into the air, the viscous dampers obey the rules of physics by following the principle of energy conservation. These small but mighty dampers raise structural damping levels to as much as 50% of critical, leading to a remarkably dramatic decrease in stress and deflection. The dependability and durability of our products are ensured by individually testing each damper at the highest forces and velocities that the customer has chosen.

1.1-Mathematical Modelling Of Fluid Viscous Dampers

The constitutive equation below idealises the behaviour of a fluid viscous damper as a pure dashpot:

Damping Force F = Damping Constant C x Velocity V^{α}

This Condition gives the connection between the damper result power and speed, where C and alpha are the damping steady and speed example, individually. The value of alpha of 1.0 represents linear dampers, whereas values other than 1.0 indicate nonlinear dampers. Specifications for alpha typically range from 0.3 to 1.0; the simple way to put it, the lower the exponent the more efficient damping for seismic energy dissipation.

1.2-Modelling Of Structure

Building description

The building analysed in this study is 12 story structure with 20x20m dimension a column of 450 mm and a total no of 36 4m center to center a beam of 230x450 mm was adopted and typical story height of 3m was adopted with typical height of 3m and a total height of 36.4m.

The second structure was 17 story with dimension of 20x20m a total no of 36 column of size 450x450mm with 4m center to center distance with typical height of 3m and a total height of 51.4m. The structure was designed as per IS code.

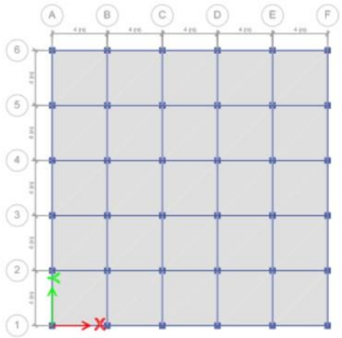


Fig Plan view of modal in ETABs

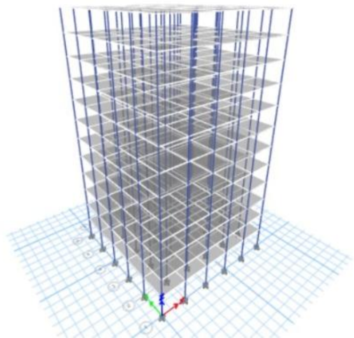
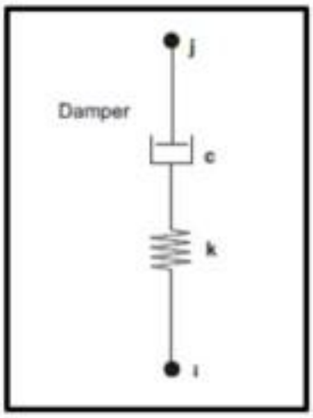


Fig 3D modal View in ETABs

1.3-Modelling of Viscous Fluid Damper



In this study the lowest force output of damper was used because the main aim was to find the effective position and for maximum damping output. Through the formal request the Company Taylor Devices inc provided the damper configuration used in this study.

Force	Spherical dia.	Mid stroke	Stroke mm	Celvis thickness	Celvis width	Celvis depth	Cylinder dia	weight
250 kn	38.10	867mm	+-75	41mm	100 max	83	115 max	41kg

Table-Suggested C value provided by taylor devices

Related force	Suggested C	Value in kN		
	Max vel=0.127m/s	Max vel=0.254m/s	Max vel=0.381m/s	Max vel=0.508m/s
250 kN	454.6	369.2	326.9	299.9

1.4-ETABs

Extended three dimension analysis building software was used in this study to modal and analyse the structure .it is a powerful tool and has been in market for a long time .It has a lot of tool for structure modelling and analysis because of that damper modelling was possible.in this study etabs 20 was used .

Fig Damper pattern 2

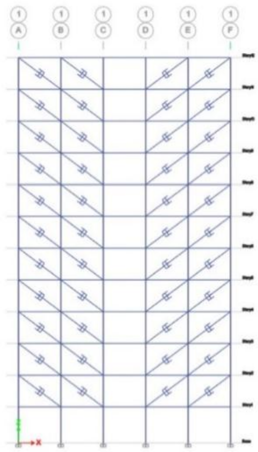


Fig Damper pattern 4

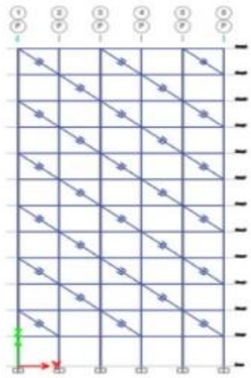


Fig-Damper Pattern 6

2-RESULT

Pattern For 12 story	No of Damper	Lateral Load	Story Shear	Max Displacement	Max Drift
Base 12 X direction	0	324.93	1655.95	41.87	0.00149
Base 12 Y direction	0	0	1655.95	2.95725E-10	2.95725E-10
Pattern 2 X direction	88	459.34	2302.87	33.89	0.00109
Pattern 2 Y direction	88	0	2302.87	0.51	2.38 E-05
Pattern4 X direction	176	660.93	3273.31	17.74	0.001286
Pattern4 Y direction	176	0	3273.31	2.05E-11	2.73 E-15
Pattern 6 X direction	112	491.84	2479.29	7.56	0.00107
Pattern 6 Y direction	112	0	2479.29	0.65	3.70 -6

Table –Output of results for 12 story structure from ETABs

1. The story shear increases from 1655 kN base 12 story to 3273 kN for structure with max number of damper for this study.
2. The most effective pattern 6 gave a max displacement of 7.65 mm compared to structure without damper 41.87mm, for 12 story structure.
3. The Drift decreased from 0.00149 of structure without damper to 0.00107 structure with damper pattern 6 as observed from result.

4. The story shear for 17 story increase form 1872 kn base model to 3270kn pattern 4.

5. The displacement reduced from 71mm without damper to 16.3 with damper pattern 6.

6. The max drift 0.0017 for base 17 story model to 0.0012 pattern 6.

Table –Output of results for 17 story structure from ETABs

Pattern For 17 story	No of Damper	Max Lateral Load	Story Shear	Max Displacement	Max Drift
Base 17 X direction	0	278.8124	1872.13	71.202	0.001752
Base 12 Y direction	0	0	1872.13	1.144E-09	0
Pattern 2 X direction	128	394.5067	2618.12	66.305	0.00154
Pattern 2 Y direction	128	0	2618.12	0.91	4E-05
Pattern4 X direction	256	495.7331	3270.89	44.195	0.001475
Pattern4 Y direction	256	0	3270.89	7.422	4.1E-05
Pattern 6 X direction	160	420.9838	2804.63	16.301	0.001256
Pattern 6 Y direction	160	0	2804.63	1.052	1.1E-05

3-CONCLUSION

- From the following Research it is concluded that Viscous Dampers Are Efficient in reducing the displacement of building.
- The displacement in Structure with damper 1st pattern and without damper is 42 mm to 33.3 form patten2. That gives the reduction in displacement of 8mm or about 20.71%.
- With Different patterns comes different efficiency.
- The minimum displacement was observed in pattern 6 which gives us the most efficient pattern.
- The Min displacement pattern of damper was confirmed by both 12 storey structure and 17 storey structure.
- The Max displacement was observed in pattern 2 the arrangement of damper is not recommended in structure, its efficiency was verified on 17 storey structure with same pattern comparing it without viscous fluid damper.
- With the increase in number of damper the lateral load increase.
- The number of damper is not directly proportional to the output of damping as we tested in pattern 3 building covered with damper.
- To see if number of damper is not directly proportional to increase in damping we can compare pattern 3 and 6.

- With just slight change in positioning keeping the number same as seen in patter 1 and 2 we can see the change in damping output.
- The increase in number of damper give more damping but the placement of damper is more important.

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