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Analyze Use Dampers in Earthquake Resistant Structure

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ABSTRACT –

Earthquake is a natural phenomenon caused due to movement of tectonic plates. It causes sudden shaking of ground surface which result in mass devastation. This are caused om edges of tectonic plates when they show a movement it causes seismic waves which arise from focus of movement and move towards epicentre located just above focus. It causes mass destruction epicentre area causes loss of lives, buildings and environment. In present year largest earthquake was recorded in Turkey- Syria of magnitude 7.8 total death count is 57,759 from which most people died due to sudden collapse of building and many were injured and dead due falling of debris. In such situation earthquake resistance technology plays a vital role. "Dampers" are part of such technology. Dampers are basically shock absorbents which help to counter a kinetic energy produced in building during seismic event which result in collapse of building due to tensile and compressive forces. There are various types of dampers are available worldwide and used according to vulnerable areas where chances of earthquake occurrence are more along with buildings load carrying capacity and serviceability.

Key Words: **earthquake, dampers, seismic events**

1. INTRODUCTION

Dampers are such devices that are able to absorb the kinetic energy produced in the building due to seismic event. Vibrations are in form of energy cause tensile and compressive forces which cause the failure of structural items, hence causing the collapse of building

Function of dampers to counter such forces, the arrangement of system in dampers depends upon the material and principle used like for example viscous dampers use fluid to convert kinetic energy into heat energy; friction dampers use steel plates which causes movement in opposite direction hence canceling forces.

Location of dampers is made in such away that it can absorb the maximum movement and forces, mainly they are arranged in diagonal to floors, attached to a site to a floor or connected to each side corner depending upon type of damper used. They can be arranged in shapes like W, V inverted depending upon loading

a. Objectives :

 The objectives of this project are as follows: -

1. To study the use of dampers for making a structure earthquake resistant.
2. To study different advantages of dampers in earthquake resistance.
3. To compare building with and without dampers.

b. Scope

• Making of spring-based dampers by taking reference of viscous dampers.

• To make dampers which are easy to construct and easy to work.

•As compared to viscous damper spring-based dampers are made easily at a cheap cost compared to viscous damper and easy to assemble.

c. Advantages:

- Easy to install in building as compared to other dampers.
- Very effective as compared to Friction and Mass tuned dampers.
- Absorb maximum kinetic energy produced during seismic event.

- It contains the silicon-based fluid which help to convert kinetic energy to heat energy.

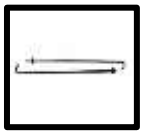
d. Disadvantages:

- They require periodic maintenance.
- Chances of breaking piston during high-scale seismic event.
- Handling and transportation is difficult at time of fixing.

f. Necessity of use of damper:

- They require periodic maintenance.
- Chances of breaking piston during high-scale seismic events.
- Handling and transportation is difficult at the time of fixing.

2. MATERIAL USED:

Sr. No	Material used	Specification	Quantity
1.	 Spring	Diameter of 12 mm	12nos
2.	 Steel Pipe	Length of 15cm	12nos
3.	 Washers	Diameter of 12mm	24nos
4.	 Battery rods	Length of 20 cm	12nos
5.	 Small washers	Diameter 10mm	12nos

Note: We have not conducted any specific test for materials in table no. 5.3.1. because we have created this model for comparative study, for comparison of buildings with damper and without damper. Also, we have not done any calculations for materials selection.

3. Methodology:

- **Steps followed for preparation of dampers and testing of model**

1) Selection of material for making dampers and assembling of material:

The material used for making our spring-based dampers were collected from the local market and was assembled with help of gas welding all the collected material was assembled into a full damper which was made from springs, battery rod, washers of 10 and 20mm, and steel pipe was used as a cover to hide these all assembly.

2) Welding of a damper in W shape:

We have welded 12 spring dampers and arranged in W shape each damper on the steel of 1ft x 1ft.The damper at edge of the plate was welded at 7.5cm from edge of steel plate and connected at bottom of other steel plate. All dampers were welded to plate in alternate manner, after welding the model was completed.

3) Coloring of Damper Model and oiling process:

We startyed to colour our damper model before oiling process coloring process is necessary because to give aesthetic view to our model. Oiling process was also necessary because oiling will help the spring inside damper to function well.

Fig.1 Single welded damper

Fig. 2 W shaped damper arrangement

4) Testing process of building model with and without damper on shaking table

1)Preparation of shaking table

Shaking table apparatus is very heavy and needs to be maintained so is properly packed. We removed the cover of apparatus cleaned and attached the base plate main plate of table by means of strong nuts and bolts along with visors/washers.

2)Fixing of Dampers on table

The damper model we created was attached to shaking table base plate using nuts,bolts and washers so that it is fixed to table properly .Holes were drilled on damper model at bottom portion using drill machine.

3)Preparing Steel model of building of G+6 Storey

The steel model of G+6 building was available for testing purpose so this model was rest on the aluminum plate which was cut into required dimension of damper model so that it can be fixed upon it. Also the building model was chamfered to make its edges smooth and holes were drilled into it for fixing it with nut and bolts and washers on top of damper model.

4)Connecting shaking table apparatus and model with damper& building to software in laptop using cables .

The software used for giving vibrations for the model is called as ‘Kampana ' and the software used for recording the readings and movements along with acceleration and velocity and displacement was ‘Shaking table software’.These were connected to laptop and cables were attached on the base plate along with 2^{nd} storey,4^{th} story and 6^{th} story of the building model to capture the slightest movements occurring on floor.

5)Applying vibrations and recording readings

reading.

The vibrations given to the shaking table was controlled by Kampana software we needed to input the data like frequency, oscillations etc. Then the shaking table software’ was controlling the start and finish of oscillations s along with graph readings displaying on it.

6)Comparing building without dampers with respect to displacement

After comparing building with using dampers we removed the dampers from shaking table and attached only building steel model using nuts bolts and washers .The building was also attached with cables on base and storeys to record the reading.

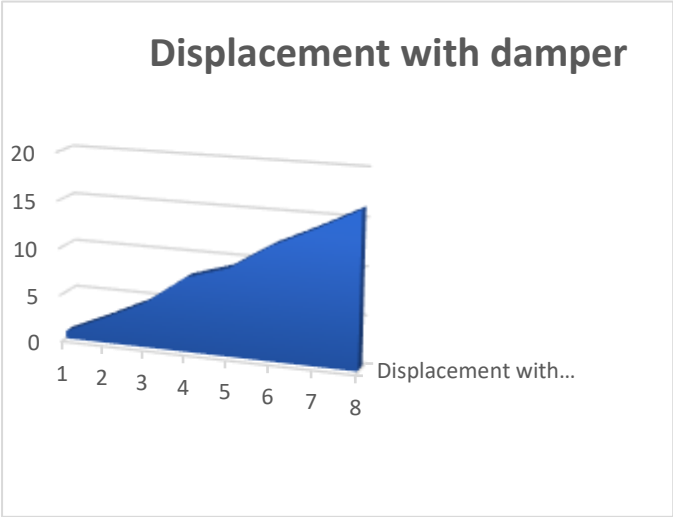
6. RESULT

6.1 Results of shaking table test on building model with and without damper

6.1.1 With Damper

Storey No.	Displacement (mm)
1	0.8
2	2.7
3	4.8
4	7.9
5	9.2
6	11.98
7	14.04
8	16.31

Table no .6.1.1

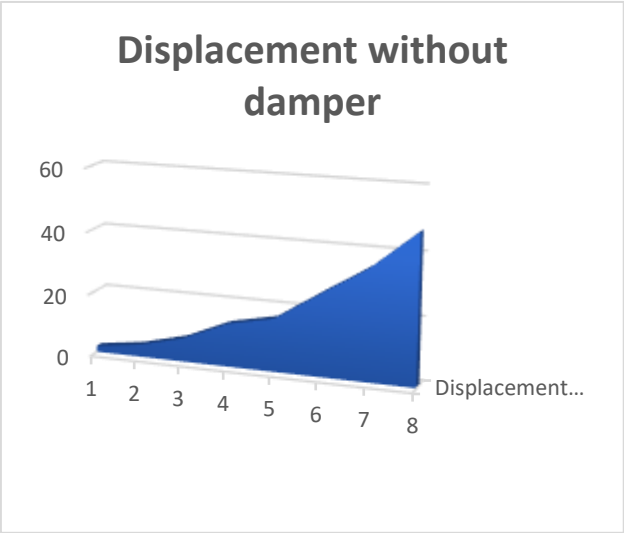


Graph of displacement vs storey with damper

6.1.2 Without damper

Storey No.	Displacement (mm)
1	1.9
2	3.9
3	7.6
4	13.8
5	16.9
6	26.25
7	35.36
8	47.47

Table no.6.2.1



Graph of displacement vs storey without damper

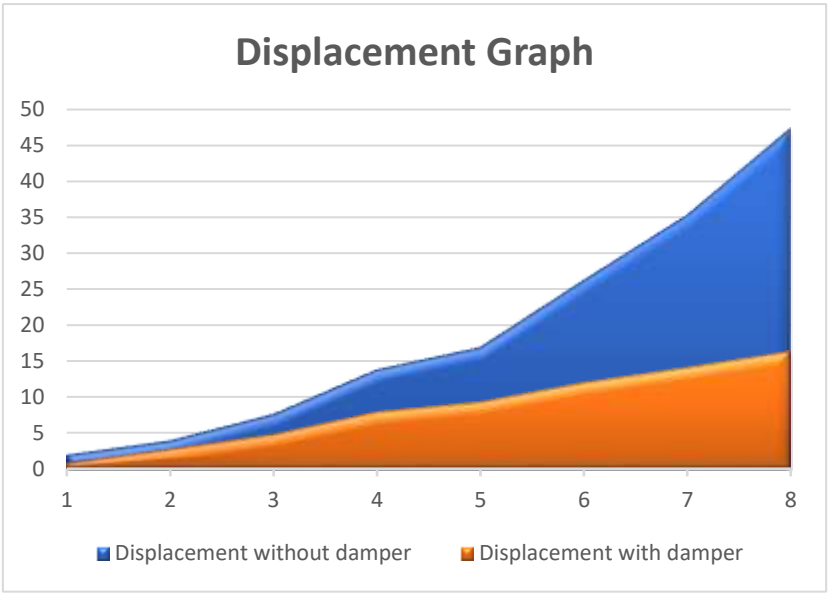
7. CONCLUSION

-The comparative analysis is useful to establish the relation between displacement of building with and without damper.

- The model of G+8 steel building shows maximum displacement readings on shaking table software.

- The model of G+8 steel building shows minimum displacement readings on shaking table software.

- We can conclude that spring-based dampers can resist vibrations from earthquake and reduce displacement of building making it safe.



8. REFERENCES

1) Construction In earthquake-prone areas in India, Yash Deshmukh[*1], Latin Hinge[*2](Peer-open access, fully refereed international journal), Volume:03/Issue:12/December-2021 Impact factor -6.752

2) A Comparative study on analysis of RCC framed structure using viscous damper, tuned damper, and friction damper, Vuyyuri Raghu[1] Dr.Ch. BHAVANARAYANA[2,] Volume 13 Issue 07,July/22, ISSN:0377-9254

3) Viscous damper development and future trends, David A. Lee Taylor devices, Inc.-SantMonica, CA. Douglas P.Taylor, Taylor Devices, Inc.-Tonawanda,NY

4) Use of viscous dampers and shock transmission units in the sismic protection of building, M.Gabriella CASTELLANO[1] Gian Paolo COLATO[2], Samuele INFANI[3,] 13[th] World conference on earthquake engineering vancouver, B.C.,Canada Agust 1-6,2004 Paper No.2172

5) IRJET-Seismicm response study of multi-storied reinforced concrete building with fluid viscous dampers, Bhawana Tyagi[1,] B.S. Tyagi, Volume:05 ISSUE 05

6) Emerging trends in civil engineering manual (22603).