Analysis of Moment Resisting Reinforced Concrete Frames for Seismic Response Reduction Factor

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Abstract - *Earthquake is the maximum vital factor to bear in mind whilst designing a building is earthquakes. For the duration of earthquakes, systems vibrate. Wind forces, earthquakes, machine vibrations, and lots of other elements can purpose vibrations. These vibrations can now and again purpose structural harm, especially below sturdy earthquake excitations. Via the use of dampers severe damage can be averted. The idea of the viscous damper is to take in shocks and vibrations from the shape. However, the maximum crucial is the place of the dampers that is a primary consideration. The viscous damper is taken into consideration the passive manipulate machine used to use up and take in strength prompted at some stage in earthquakes due to earthquakes. The principle reason of the utility of dampers is to decorate the stiffness and stability of the shape and make the shape earthquake resistant. The present look at is targeted at the study of the seismic conduct of buildings with dampers and evaluating seismic responses to displacement and different elements.*

Key Words: (Viscous Dampers, Visco- Elastic Damper, Displacement

1. INTRODUCTION

An earthquake is an effective shaking of the earth's surface that can be deadly to hundreds of people and cause severe harm. They may be delivered on through the unexpected release of electricity from tectonic plate movements within the Earth's crust. Seismic waves are the manner by which this strength is discharged. The most excessive and unanticipated herbal calamities are earthquakes. Inside the worst scenario, the massive amount of energy produced in the course of an earthquake might also result in serious injury or the destruction of vital structures. Civil structures like excessive-rise homes, skyscrapers, and lengthy span bridges are designed with more flexibility as a result of the speedy financial development and contemporary generation, which increases their susceptibility to external excitation. Consequently, these bendy systems are vulnerable to being uncovered to extraordinarily excessive degrees of vibration inside the occasion of a robust wind or earthquake. With the intention to hold such civil projects from suffering sizeable harm, the reaction reduction of civil systems for the duration of dynamic loads such massive earthquakes and excessive winds has come to be a crucial topic in structural engineering. The forces triggered at some point of the earthquakes need to be resisted by way of the systems with out suffering any important structural damage. All systems have to be designed to withstand lateral hundreds in several ways. The maximum commonplace lateral masses resisting systems are moment frames, shear wall and braced frame. Passive electricity dissipating structures are also used as an alternative to seismic isolation which protects the systems in opposition to the earthquakes. The application of such structures enhances the power soaking up potential of structures.

The maximum not unusual types of these structures consist of fluid viscous dampers, friction dampers, tuned mass dampers and steel dampers. In the present examine one of the passive power dissipating gadgets is used and the seismic behaviour of the constructing is studied.

1.1 VISCOUS DAMPERS

Viscous dampers, additionally called seismic dampers, are hydraulic additives that diffuse kinetic strength precipitated for the duration of earthquakes and soften structural collisions. They may be adaptable devices that can be made to provide for every managed and out of control dampening of systems to protect them from earthquake.

Fig -1: Viscous Dampers

1.2 VISCOELASTIC DAMPER

Viscoelastic (VE) dampers have been effectively fused in various tall structures as a reasonable vitality scattering framework to smother wind-and quake initiated movement of building structures. This sort of damper disperses the structure's mechanical vitality by changing over it into heat.

A few factors, for example, encompassing temperature and the stacking recurrence will influence the presentation and subsequently the viability of the damper framework. VE dampers have had the option to expand the general damping of the structure essentially, subsequently improving the general execution of powerfully touchy structures.

Fig -2: Viscoelastic Dampers

1.3 FLUID VISCOUS DAMPER

Fluid viscous dampers are one of the passive energy vanishing devices, for controlling vibration caused in structure and mechanical systems. In military and aerospace industry they use extensively these type of dampers from past years now a days these are used in the buildings to control the vibrations caused by wind and earthquakes. One of the greatest unique capacity of the dampers is it will together decreases both the stress and deflection within the structure subjected to transient. This is because the dampers vary its force only with the velocity, due to flexing of the structure the response that is permanently out of phases with the stresses. To vanishes the energy in the building these dampers are used because these dampers are velocity dependent. To reduce the responses in the building these effective damping should be done by using these type of dampers. FVDs are frequency independent devices without a stiffness component.

2. SCOPE AND OBJECTIVE

2.1 Scope:

To perform the seismic analysis of multi storey RCC building (G+8) with and without dampers

2.2 Objective:

- To study the behavior of structure with and without dampers
- To study and evaluate seismic responses such as displacement. Acceleration.
- To study Time History utilizing VD and VED in structures

3. METHODOLOGY

More than one-story structures come under the multi Stages of freedom systems. In multi tiers of freedom Structures the deformation of an entire shape cannot be related by using a single displacement, more than one Displacement coordinates are wanted to become aware of the displaced structures.

3.1 Methods of analysis

3.1.1 Equivalent static method: An equivalent static method is also referred to as an equal lateral pressure method. Seismic analysis on a building is carried out on the assumption of the horizontal pressure is just like the dynamic loading, inside the technique durations and shapes of higher modes of vibration aren't required so the effort for the evaluation is much less, besides the fundamental length. The base shear is calculated depending on the mass of the shape, its fundamental intervals of vibration, and shapes. First of all the bottom shear is calculated for an entire shape then alongside the peak of the building distribution is executed. At each ground level, the lateral force acquired is allotted to every structural detail. This method is usually followed for an extremely low to medium peak constructing.

3.1.2 Response spectrum method: Reaction spectrum technique is likewise called as a modal Technique or mode superposition technique. This method is utilized in a structure where the modes will have an effect on the Reaction of shape apart from the fundamental one especially this technique used for a dynamic analysis of a Building which can be asymmetrical in plan or irregularity in areas. In case of multi storied homes to find the Forces and displacements brought about because of medium variety Earthquake movement this technique is used for evaluation.

- For the study purpose reinforced concrete structures are considered, having G+8 stories of height 3.1 m each Floor.
- R.C.C. regular Structure design on E-tab Software.
- The number of storey and floor height is kept constant for all models in order to get consistent results
- To understand the behaviour under seismic loads the loads are applied as per IS 1893: 2002.
- Design the structure with and without dampers.

3. RESULTS AND CONCLUSION

The results are used to conclude the suitability of dampers

3.1 Displacement of Storey:

3.1.1 Storey Response Displacement in mm in x-direction for G+ 8

Table no 1: Storey Response Displacement

Storey	Elevation (m)	Displacement (mm) without dampers	Displacement (mm) With dampers
		X-Dir	X-Dir
8	24.8	44.17	25.62
7	21.7	41.15	23.03
6	18.6	39.71	22.12
5	15.5	35.13	20.25
4	12.4	32.75	19.25
3	9.3	31.95	18.53
2	6.2	22.04	12.78
1	3.1	10.03	5.82
0	0	0	0

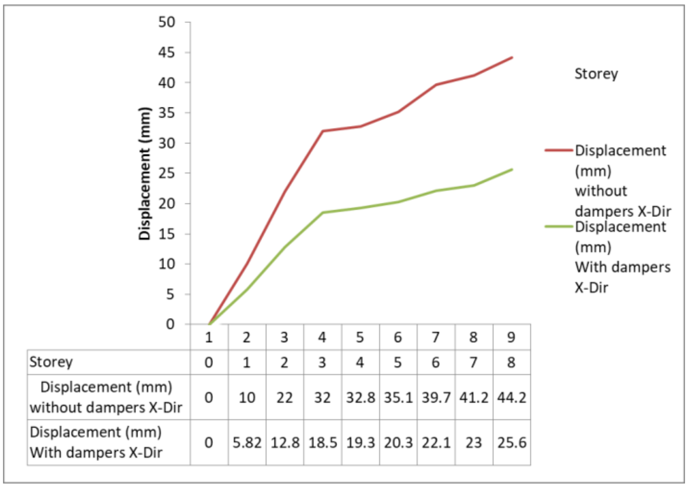

Fig -3: Graph of Story Response x direction

Table no 2: Storey Response Displacement

Storey	Elevation (m)	Displacement (mm) without dampers	Displacement (mm) With dampers
		Y-Dir	Y-Dir
8	0	39.97	23.58
7	3.1	37.74	20.85
6	6.2	35.34	19.15
5	9.3	32.15	18.15
4	12.4	29.62	17.15
3	15.5	27.47	16.21
2	18.6	19.99	11.79
1	21.7	9.24	5.45
0	24.8	0	0

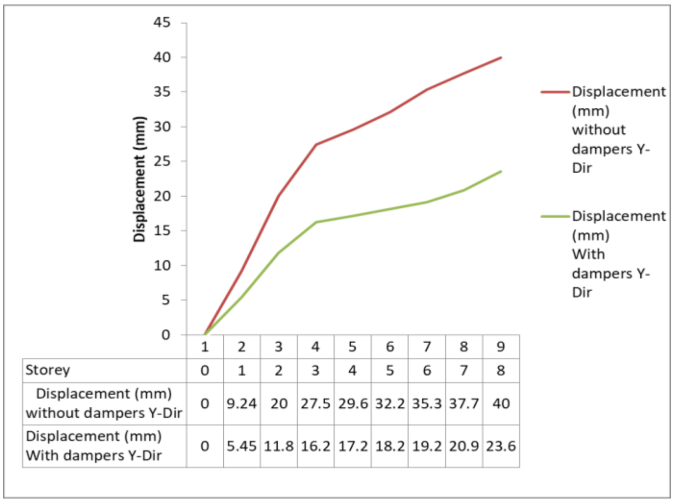

Fig -4: Graph of Story Response y direction

a) The graph shows displacement v/s height of the building for G + 8 building with dampers applied at alternate storeys.

b) The permissible displacement as per IS code is (H/500) i.e, (24800/500) = 49.6 mm

c) The maximum displacement obtained is 25.62mm in X-direction.

d) The displacement obtained was 49.6 mm without dampers and with the application of dampers the displacement has been reduced to 25.62 mm.

e) Application of viscous dampers have reduced the displacement by 42%

3.1.2 Storey Response Displacement in mm in x-direction for G+ 12

Storey	Elevation (m)	Displacement (mm) without dampers		Displacement (mm) With dampers	
		X-Dir	Y- Dir	X-Dir	Y- Dir
12	37.2	106.4	94.05	57.45	50.79
11	34.1	100.11	87.52	54.06	47.26
10	31	94.15	78.34	52.72	43.87
9	27.9	92.53	76.45	51.81	42.81
8	24.8	89.51	73.63	50.13	41.23
7	21.7	85.01	69.62	47.61	38.99
6	18.6	78.66	64.23	44.05	35.97
5	15.5	70.76	57.72	39.62	32.32
4	12.4	61.73	50.16	34.57	28.09
3	9.3	51.68	41.72	28.94	23.36
2	6.2	40.3	32.64	22.57	18.28
1	3.1	26.34	21.6	14.57	12.09
0	0	0	0	0	0

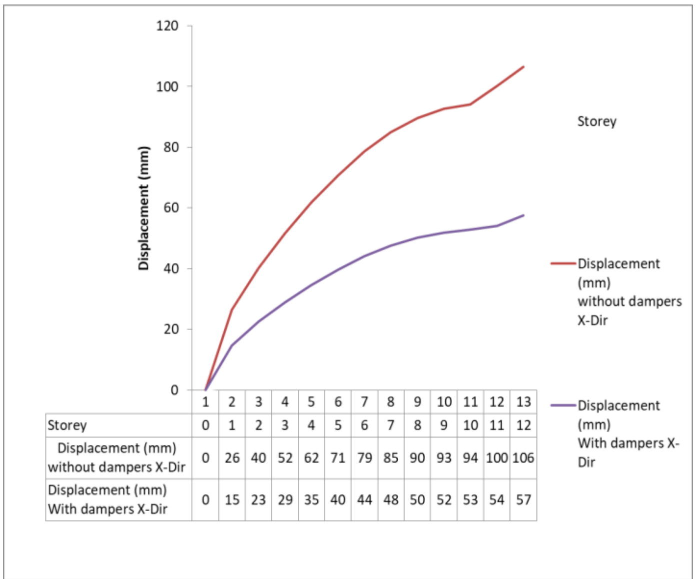

Fig -5: Graph of Story Response x direction

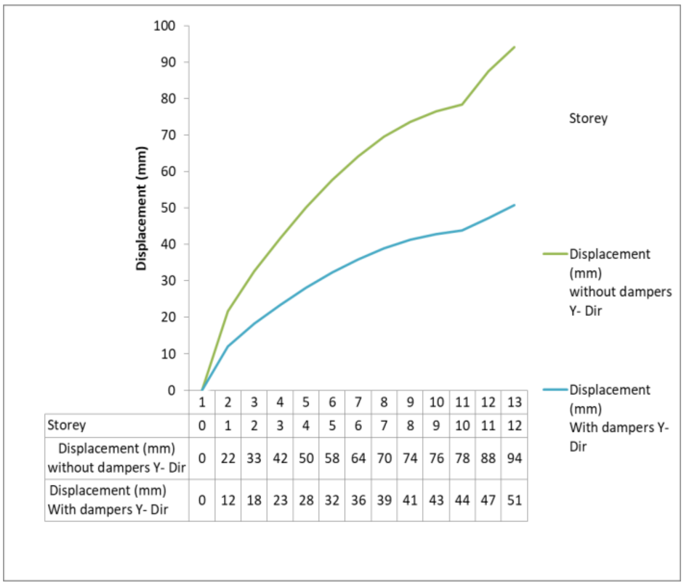

Fig -5: Graph of Story Response y direction

a) The graph shows displacement v/s height of the building for G + 12 building with dampers applied at alternate storeys.

b) The permissible displacement as per IS code is (H/500) i.e, (37200/500) = 74.4 mm

c) The maximum displacement obtained is 57.45 mm in X-direction.

d) The displacement obtained was 106.4 mm without dampers and with the application of dampers the displacement has been reduced to 57.45 mm.

e) Application of viscous dampers have reduced the displacement by 45.15 %

4. CONCLUSION

a) The structure evaluated with the application of dampers to be efficient and viscous dampers can serve as better energy dissipating device.

b) It can be conclude that, with the application of viscous dampers the seismic performance of the structures can be improved against earthquakes.

c) Non-Linear dynamic analysis shows the actual response of the structure subjected to earthquakes.

d) In G+8 building with the application of viscous dampers we can see a reduction of displacement by 42%.

e) In G+10 building with the application of Viscous dampers we can see a reduction of displacement by 45.15%

f) Application of Viscous dampers significantly increases the stability and stiffness of the structures.

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