International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

A REVIEW OF SEISMIC BEHAVIOUR OF MULTI-STORY BUILDING USING VARIOUS ENERGY DISSIPATION SYSTEM

Qamar Ahamad[1], Faheem Ahmad Khan[2]

[1]*M.Tech Student, Department of Civil Engineering, BBD University, Lucknow, India*
[2]*Assistant Professor, Department of Civil Engineering, BBD University, Lucknow, India*

Abstract - *In this review paper we study that multi-story building with underground story for parking space and storage are very common in practice. Now a day, seismic energy dissipating devices are being used for various types of structures and located in basements which are difficult to maintain. The main objective is to evaluate the effectiveness of horizontal dampers in the ground floor level of the multi-story building above basement. Among different types of dampers, viscous- dampers are used for this numerical study. Comparing with other types of passive energy dissipating devices, viscous dampers are considered most suitable. For the better understanding of the effectiveness of horizontal dampers, stiff foundation system is considered thus soil-structure interaction is omit-ted. In this numerical study, seismic response of different hypothetical structures analyzed having different underground stories and horizontal dampers only in the ground level. Modeling and analysis of the structures and installation of the dampers are done by using finite element modeling software [ETABS]. Different dynamics parameters such as natural time period, displacement, base shear and inter-story drift were evaluated. Changes in the results among the structures demonstrated the efficiency of horizontal dampers. Optimum locations of the horizontal dampers were also revealed in this study in the basis of the analysis results*.

Key Words: Mass Damper, viscous damper, Lead rubber bearing, Time history method, Etabs.

I. INTRODUCTION

In multistory building, various energy dissipation systems has been widely used for vibration control in mechanical engineering system. It is useful to reduced vibrations in tall building and make safe and economical. This paper presents we use various energy dissipation system namely Mass damper, viscous damper and Lead rubber bearing damper for vibration control.

1.1 Mass tunned damper

Tuned mass dampers stabilize against violent motion caused by harmonic vibration. A tuned damper reduces the vibration of a system with a comparatively lightweight component so that the worst-case vibrations are less intense. Roughly speaking, practical systems are tuned to either move the main mode away from a troubling excitation frequency, or to add damping to a resonance that is difficult or expensive to damp directly. An example of the latter is a crankshaft torsional damper. Mass dampers are frequently implemented with a frictional or hydraulic component that turns mechanical kinetic energy into heat, like an automotive shock absorber.

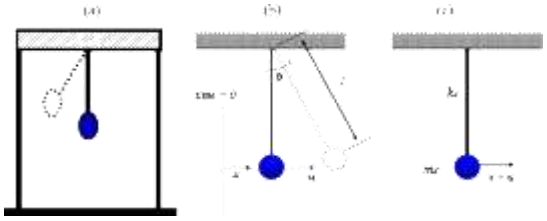

Fig.(a). Mass Damper

1.2 Viscous damper

Viscous dampers are hydraulic devices that dissipate the kinetic energy of seismic events and cushion the impact between structures. They are versatile and can be designed to allow free movement as well as controlled damping of a structure to protect from wind load, thermal motion or seismic-events.

Available in ratings up to 1,000 KIP, seismic dampers are well suited for large displacement and/or large load applications such as bridges, buildings, and large structures. Viscous damping force is a formulation of the damping phenomena, in which the source of damping force is modelled as a function of the volume, shape, and velocity of an object traversing through a real fluid with viscosity.

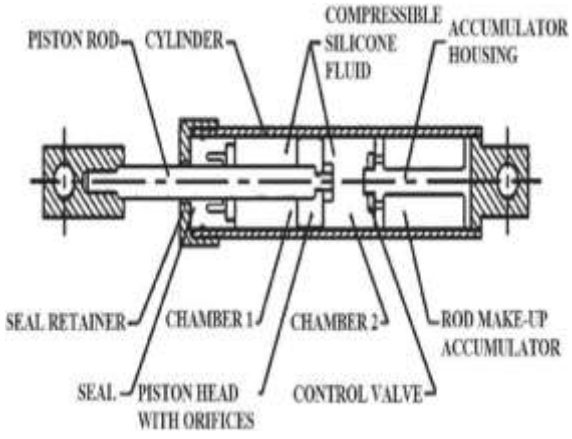

Fig.(b).Sectional view of fluid viscous damper

1.3 Lead rubber bearings

LRB is a type of base isolation employing a heavy damping. It was invented by William Robinson, a New Zealander. Heavy damping mechanism incorporated in vibration control technologies and, particularly, in base isolation devices, is often considered a valuable source of suppressing vibrations thus enhancing a building's seismic performance. However, for the rather pliant systems such as base isolated structures, with a relatively low bearing stiffness but with a high damping, the so-called "damping force" may turn out the main pushing force at a strong earthquake. The bearing is made of rubber with a lead core. It was a uniaxial test in which the bearing was also under a full structure load. Many buildings and bridges, both in New Zealand and elsewhere, are protected with lead dampers and lead and rubber bearings.

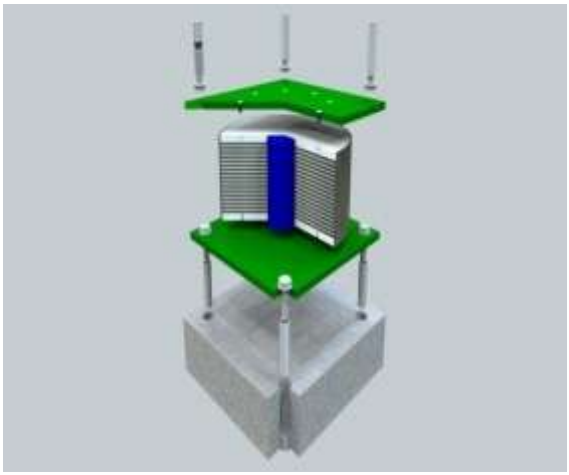

Fig.(c).Lead rubber bearing

II. LITERATURE REVIEW

Abhishek Kumar Maurya[1](2018)

Frequent earthquake round the globe and large number of structure vulnerable to the need for structural response control to gain pace in application around the globe. The seismic performance of the behaviour of structure ameliorated of dynamic energy is vanished in a manner independent of structural component. In this paper vibration parameter of the multi-story RC building has been analysed. The comparison between the seismic behaviour of fixed base without damper building to the planned building in which dampers are incorporated at different location i.e. at Middle and at Corners bays of each storey. G+20 building model is taken and it is situated in seismic zone V and the analysis is carried out on all models to get the variation in structural behaviour of the fixed RC building without damper and the building linked with viscous damper at different locations. The analysis id done through Time history analysis using software ETABS 2016. For Time History Method, seismic event of India (Sikkim)-Nepal-Border Region into calculation of Mode Shapes and Base shear under dynamic loading of RC building that have been studied in this paper.

Deepak Patel[2](2017)

In this paper vibration parameter of the multi-storey reinforced concrete building are analysed, which has mass irregularity and their seismic behaviour is compared with reference to the proposed building i.e. damper is attached at different location such as (at middle, at corner). The result of the analysis is obtained that the difference in structural response of the Fixed RC building with the Building utilizes with the viscous damper at different locations.

Kishan Bhojani[3](2017)

During the life span of structure there may be an effect of vibration due to an earthquake. Due to vibration of an earthquake there may be major or minor damage in building. The best method to reduce the seismic response of the structure is base isolation. It gives idea about base isolation system which can be used in multi-story building to reduce the vibration of seismic response of the structure. This represents the initialize study of dynamic parameter like effective damping for four earthquake time history, response spectrum. In this paper the optimum effective damping has been found out under the effect of Alcentro Data earthquake time history. The parametric study has been conducted to evaluate the effect on maximum story displacement, maximum base shear, maximum stiffness in bare frame and frame with isolator.

Vishal B. Patel[4] (2017)

In this paper it present in higher earthquake zone area are liable to get damaged or collapsed hence to increase the safety of these structure few retrofitting techniques are done. It investigates the response of multi-storey structures under simulated earthquake loads with viscous dampers and consequently, evaluations are made as to how the damping systems affect the seismic response of these structures with respect to deflections and base shear. This paper concentrates on the effects of damper locations i.e middle or corner within the multi-story building having mass irregularity. The seismic event of ALCENTRO is taken in the analysis, which we can consider as extreme seismic event. The main aim of the study is to compare the results of incorporated damper at different locations such as at corner or at middle in the reinforced concrete multi story building.

Puneeth Sajjan[5] (2016)

All structures are mainly subjected to various types of load such as earthquake, wind loads etc. During earthquake zone areas, the structures are designed for considering seismic force. The structure which are present in high earthquake zone area to get damaged or collapsed, hence to increase the safety of these structure few retrofitting techniques to

stabilize the structures against the earthquake forces. If the retrofitting techniques are adopted then cost plays an important role and possibly few spaces will be compromised depend upon the type of methods adopted. Then the structure may be strengthened by adding materials externally to transfer the lateral loads to the ground i.e. some protective devices have been developed. Damping devices are used to reduce the seismic energy and enable the control of the structural response of the structure to that1earthquake excitation in modern. An 8-story structure which is symmetrical in plan is modelled and analyzed using the ETABs 2015 software. IS1893-2002 (Part 1) is used for an earthquake loads . To analysis of the structure, the static and dynamic analysis method is used.

Alireza Hesami[6](2015)

It investigates types of dampers and their performance during an earthquake. They have investigated the high building in the world and satisfactory level of damper performance has been studied. The results shows that no dampers have an acceptable seismic behaviour against lateral forces such as wind loads and earthquake forces. But it has reduced the vibration construction limitations of multi-storey building.

Ashish A. Mohite[7] (2015)

A Tuned mass damper (TMD) and viscous damper is a device to a structure in order to reduce the dynamic response of the structure. The frequency of the damper is tuned to a particular structural frequency so that when that frequency is excited, the damper will resonate out of phase with the structural motion. As high buildings keep becoming taller they become more susceptible to dynamic excitations such as wind, earthquake and seismic excitation. For the structure safety and occupants comfort, the vibrations of the tall buildings are serious concerns for engineers. In order to mitigate the vibration, different approaches i.e. mass damper and viscous damper have been proposed, among which Tuned Mass Dampers (TMDs) is one of the most preferable and have been widely used. Tuned mass damper and without tuned mass damper by using software Etabs 2016, moment resistance frames are column and girder plane frames with fixed or semi rigid connections.

Mital N. Desai[8](2015)

This paper represents comparative study of performance of three types of base isolators namely High Damping Rubber bearing (HDRB), Low Damping Rubber Bearing (LDRB) and Lead Rubber Bearing (LDRB). A 8 multistorey building has been analysed using Response Spectrum Method. By using ETABS 2016 software, Dynamic analysis has been done. Parameters like Base shear, Building displacement and frequency are compared for the building with base isolator and building with fixed base.

Yuvraj Bisht[9] (2014)

January 2001 Bhuj Earthquake in India, many multi-story buildings in urban areas collapsed and suffered huge damages. By using energy absorbing devices, seismic performance of a building can be improved which may be active in nature. Due to its high cost and large instrumentation set up active control techniques has not found much appreciation and passive control systems such as base isolation, dampers etc. are found to be easy to install and cost effective as compared to previous once. Use of damper is now becoming cost effective solution to improve seismic performance of a new building. It deals with use of viscous dampers in the building. A 5 multistorey building with a open ground storey is analysed with and without viscous dampers placed at soft storey.

Yuwei Dai[10](2013)

The mass damper for reducing vibration of tower subjected to multi-dimensional seismic excitation is studied. Calculation model of mass damper is introduced, and the equations of motion of a tower with mass damper are derived and the calculation parameters of mass damper are given based on control structure. For a practical engineering, the multistory building model is established using Etabs 2016.

III. CONCLUSION

We use various energy dissipation systems in G+ 20 multi stories building to reduce the vibration of the same building. We use mass damper, viscous damper and lead rubber bearing damper. We conclude that the multi-storey building with damper is more safe and economical than the multi-storey building without damper. Dampers are useful to reduce the vibration of the building during an earthquake.

IV. REFERENCES

[1].Abhishek Kumar Maurya ,"Energy Dissipation System In Multi-Story Building ,"

[2]. Dipak Patel, "EnergyDissipation System In Multi-Story Building," IJIRSET, e-ISSN (O): 2348-4470, *Volume 4, Issue 6, June -2017*.

[3].KishanBhojani ,"Seismic Vibration Control of Building With Lead Rubber Bearing ," Kalpna Publication (2017),Volume 1, 2017.

[4].Vishal B. Patel,"Energy Dissipation System In Multi-Story Building Using Viscous Damper,"IJAERD (2017). Department of Structural Engineering, BVM Engineering, Collage Gujrat.

[5].PuneethSajjan, "Study on The Effect of Viscous Damper For RCC Frame Structure", IJRET (2016)

[6].AlirezaHeysami ,"Types of Dampers and Their Seismic Performance During an Earthquake ," CWE , Vol. **10**(Special Issue 1), 1002-1015 (2015).

[7].Ashish A. Mohite, "Earthquake Analysis of Tall Building With Tuned Mass Damper ,"IOSR (2015), Department of Civil Engineering, Rajarshi Shahu Collage of Engineering Tathawade, Pune, Maharashtra.

[8].Mital N. Desai ,"Comperative Study of Multi-Story Building with Different Base Isolation ," IJIRSET.

[9].YuvrajBisht,"Seismic Behaviour Of A Soft Story Building With And Without Viscous Damper," IJERA (2014). Department of Civil Engineering, Nit Kurukshetra, Haryana.

[10].Yuwei Dai, "Tuned Mass Damper for Vibration Control of Multi-Story Seismic Excitation," Trans Tech Publication (2013).