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Survey Paper on Study the Performance of High Rise Structure with Dampers at different Location

Ankit Jain[1], R. S. Talikoti [2]

[1]P.G. Student
[2]H.O.D, Civil Engineering Department, Late G. N. Sapkal College of Engineering, Maharashtra, India

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Abstract - *Now a day damping devices have been developed in order to reduce effectively the seismic response of structures subjected to earthquake forces. The use of the devices in a structure can increase the costs, and then optimization of number and location of dampers is necessary.* This thesis describes the results of a study on the seismic behavior of a structure (G+7) with and without damper. *Equivalent static and non-linear response spectra analysis will be performed on model. Maximum storey deflection, storey drift, maximum moment in column has to be calculated. A RCC G+7 storey building is to be consider for the analysis. Number of damper to be used will be kept constant, and performance of the structure will be check. Based on result efficient location of damper will be selected. For the analysis etab 2013 software is used.*

Key Words*: *Equivalent static, non-linear response spectra analysis,* damper, *storey deflection, storey drift.

1. INTRODUCTION

Seismic isolation of a structure reduces the transfer to the structure of ground motion produced by an earthquake. There is various type of system available to reduces the seismic effect on the structure. The use of such devices in a structure can increase the costs. Then optimization of number and location of dampers is necessary. Seismic isolating system helps in reducing of seismic effect on structure. Several devices have been tested experimentally over the world some of these have been implemented in buildings around the world. high-rise buildings built in seismic areas is a challenge for the designers, since they should reduce the vibrations induced by both strong winds and earthquakes, and the optimal behavior in these two situations is not usually the same in that case dampers is very effective. The damper devices are easy to manufacture and implement in structures. The dampers are economical to manufacture due to the selection of material and its availability. In the unlikely situation of damage to a damper, it can easily be replaced or readjusted.

1.1 SCOPE AND OBJECTIVE

The main objective of this dissertation is focused on the behavior of RC frame under Equivalent static and non- linear response spectra analysis of building with and without dampers.

Followings are the objectives of the present work:

- To perform Equivalent static and non- linear response spectra analysis of building with and without dampers. In E-tab software.
- Modeling of Visco-elastic damper in E-tab software.
- To study the behavior of building for different location of dampers.
- Study of results in terms of displacement, story drift, base reactions and base shear.
- To assess how the variation of placement of dampers affect the seismic response of a frame structure.

1.2 REVIEW OF LITERATURE

Waseem Khan, Dr.Saleem Akhtar, and Aslam Hussain., 2014[1] has done research work on "A Non-linear time history analysis of tall structure for seismic load using damper". Has describes the results of an extensive study on the seismic behavior of a structure with damper and without damper under different earthquake acceleration frequency like EQ Altadena , EQ Lucerne, EQ Pomona, EQ Smonica and EQ Yormo. The proposed procedure is placed the dampers on the floors of the ninth-floor and five-floor of a ninth story building frame then compare the different performance of structure with damper up to Ninth-floors, damper up to Fifth-floors and without damper of ninth-story building frame using SAP2000 V15. As per IS-1893 2002 non-linear time-history analyses of frame structure indicate that maximum displacement, maximum base shear and maximum acceleration effectively reduce by providing the damper in building frame from base support to fifth- floor and base support to ninth-floor comparison to as usual frame.

Mohit Sharma, and Dr. SavitaMaru., 2014(2) Presented paper on "Dynamic analysis of multistoried regular building". Has mentioned that analysis and design of buildings for static forces is a routine affair these days because of availability of affordable computers and

specialized programs which can be used for the analysis. On the other hand, dynamic analysis is a time consuming process and requires additional input related to mass of the structure, and an understanding of structural dynamics for interpretation of analytical results. Reinforced concrete (RC) frame buildings are most common type of constructions in urban India, which are subjected to several types of forces during their lifetime, such as static forces due to dead and live loads and dynamic forces due to the wind and earthquake.

Wakchaure M. R., and Ped S. P., 2014(3) Presented paper on "Earthquake analysis of high rise building with and without in filled walls". In this study the effect of masonry walls on high rise building is studied. Linear dynamic analysis on high rise building with different arrangement is carried out. For the analysis G+9 R.C.C. framed building is modeled. Earthquake time history is applied to the models. The width of strut is calculated by using equivalent strut method. Various cases of analysis are taken. All analysis is carried out by software ETABS. Base shear, storey displacement, story drift is calculated and compared for all models. The results show that infill walls reduce displacements, time period and increases base shear. So it is essential to consider the effect of masonry infill for the seismic evaluation of moment resisting reinforced concrete frame.

Timothy Paul Jester, 1992(4) Presented paper on "Comparative study of Visco-elastic seismic damping systems". Has stated that there are two types of Visco-elastic (VE) seismic dampers for building structures, the VE diagonal damper and the VE passive mass damper which are studied in this thesis. The thesis reviews the relevant theoretical considerations in earthquake engineering and discusses the properties of VE materials important in damper design. It presents analytical equations for determining the damping added for each system. Finite element modeling of each system is used to determine the effectiveness of the dampers at reducing the seismic response of a prototype frame structure. Current design methods are reviewed, where possible. The effects of variation in the important design parameters are studied. For the VE diagonal dampers, these parameters include the stiffness of the supporting brace and the thickness of the VE material, whereas for the VE passive mass dampers, they included the damper mass, the number of dampers and the tuning frequency of the dampers.

Jinkoo KIM, And Chang-Yong LEE., 2000(5) Presented on "Analysis of a non-proportionally damped building structure with added Visco-elastic dampers". Has stated that in the analysis of a structure installed with Visco-elastic dampers the modal strain energy method has been generally applied to predict the equivalent damping ratios of the system [Lai et. al., 1995]. The method derives the equivalent damping ratios based on the assumption that the damping is proportional to mass and/or stiffness of the structure system. However the assumption of proportional damping may no longer be valid when the Visco-elastic dampers are added to the structure.

2. THEORETICAL CONTENT

Now-a-days in construction industries built up for taller and lighter structure, Seismic safety of these structures is important. This types of structure more damages due to earthquake, resulting in increased loss of human life due to collapse of building. To reduce this seismic risk various types of structural control technology have been develop to solve the safety and functional problems for structures under the excitation of external force. In last few years in war footing step to research and development structural control system such as base isolation, shear wall, bracing, damping device.

Structural damping is critical parameter for all structures that are or may be subjected to dynamic loading. Structural dampers are implemented in buildings to deal with the dynamic excitation. Dampers are efficient in the sense that they dampen the energy input due to dynamic loading through various mechanisms. The energy gained due to dynamic loading is dissipated through the various mechanisms as heat or as deformation i.e. elastic strain energy. There are many types of dampers such as the frictional dampers, metallic dampers, Visco-elastic dampers, Tuned Mass Dampers, Tuned Liquid Dampers. A recent development has led to damping by magnetic induction.

Response spectrum analysis:

A response spectrum is simply a plot of the peak or steady-state response (displacement, velocity or acceleration) of a series of oscillators of varying natural frequency, that are forced into motion by the same base vibration or shock. The resulting plot can then be used to pick off the response of any linear system, given its natural frequency of oscillation. One such use is in assessing the peak response of buildings to earthquakes. The science of strong ground motion may use some values from the ground response spectrum (calculated from recordings of surface ground motion from seismographs) for correlation with seismic damage. If the input used in calculating a response spectrum is steady-state periodic, then the steady-state result is recorded. Damping must be present, or else the response will be infinite. For transient input (such as seismic ground motion), the peak response is reported. Some level of damping is generally assumed, but a value will be obtained even with no damping.

The main limitation of response spectra is that they are only universally applicable for linear systems. Response spectra can be generated for non-linear systems, but are only applicable to systems with the same non-linearity, although attempts have been made to develop non-linear seismic design spectra with wider structural application. The results of this cannot be directly combined for multi-mode response.

3. METHODOLOGY

As stated earlier the main objective of this dissertation is focused on the behavior of RC frame building with and without damper under Equivalent static and non-linear response spectra analysis in ETABS – 2013 software.

Model-1 building without dampers
Model-2 building with dampers at base
Model-3 building with dampers at storey-1
Model-4 building with dampers at storey-2
Model-5 building with dampers at storey-3
Model-6 building with dampers at storey-4
Model-7 building with dampers at storey-5
Model-8 building with dampers at storey-6
Model-9 building with dampers at storey-7

4. CONCLUSIONS

Conclusions of papers that I had referred
1. Damper help in reducing the effect of lateral deflection.
2. Seismic performance of building after application of damper is much better when we provide dampers.
3. The frame is safer when damper is provided as compare with other arrangements.
4. Application of Visco-elastic damper reduces large amount of displacement of the structure.
5. Story drift gets reduced considerably as story displacement is reduced after application of Visco-elastic damper in the building.
6. Base shear reduction one can make the structure cost effective.

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