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Base Isolation System: A Review

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ABSTRACT: *Base isolation has become one of the reliable tools for earthquake resistant design of the structure. Researchers have done various important researches on the base isolation system, which has been fully accepted in the engineering field. Nowadays, a full-scale test is being done on the shake table to test the different features of different isolators. The present review essence literature and theoretical aspect available on base isolation system. Some of the research papers also deal with the effectiveness of variously available isolator and their applicability. It is stated in this review paper that its main objective is to focus on the background of different isolators and also to provide the useful guideline for making suitable choices between a large numbers of available isolators. The main objective of the present paper is to focus on the background of different isolators and provide useful guidelines in making a suitable choice between a large numbers of available isolators.*

Keywords: *Base Isolation , Seismic Design*

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I. INTRODUCTION

In the last few years, using base isolation systems as a mean of a seismic design of structures has attracted considerable attention. Different designs for base isolators have special features in common, the most important of which are the horizontal flexibility and the energy dissipation capacity. Base isolation can greatly reduce earthquake intensity and losses, which directly reduces the shaking intensity and damage that permanent equipment and building contents experience during earthquake ground shaking. Base Isolation is one of the passive energy dissipation techniques for earthquake resistant designs of a structure. It is useful to controlling energy, which is passing from foundation or ground to the upper stories. The main use of isolation system is to decrease the displacements, base reactions and member forces in structure. The different studies have been performed on structural isolation system. To understand the difference between the responses of fixed base and isolated base structure, to determine the effectiveness of different isolator and to study the isolator properties in detail the brief review of some papers is given in this article.

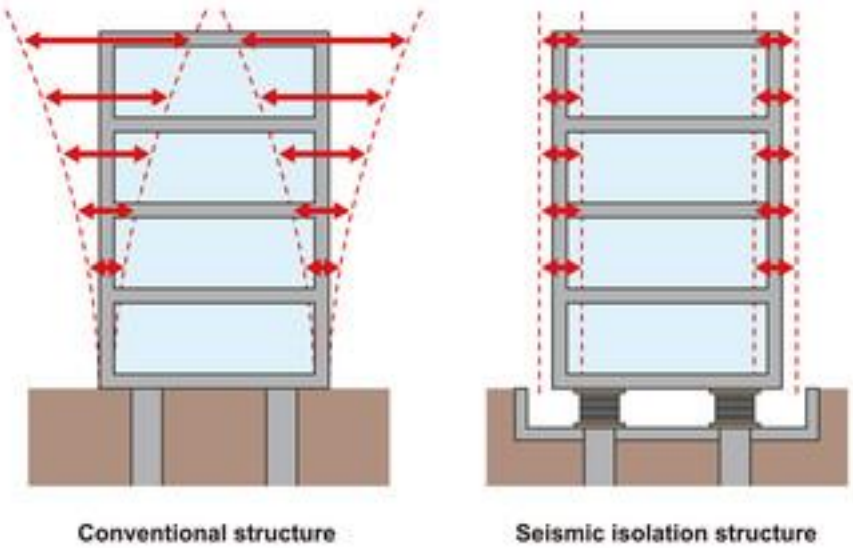

Fig 1: Conventional and Seismic Isolation Structure

II. LITERATURE REVIEW

There are following the brief review of various base isolated buildings by some researchers:

Lin Su et al (1991) In this paper Lin Su, Goodarz Ahmadi and Iradj G. Tadjbakhsh, discussed the analysis on a new combination of base isolator obtained after combining the properties of electricity de France (EDF) base isolator and resilient base isolator(R-FB1) device, and new isolator formed which named sliding resilient base isolation system (SR-F). For these isolator response spectra, a curve is generated and compared with that which is finding by EDF and R-FB1 isolator system. Whatever results are received, they are compared with fixed base system. For various conditions and various earthquake records, we found Base shear, spectral acceleration, and spectral displacement. Different results obtained from this different earthquake records were then compared with SR-F new proposed isolator. Peak response of all earthquakes for EDF and R-FB1 were recorded and obtained results are compared to the SRF system. Therefore, maximum responses almost ended without large base displacement and the peak response of this isolator was also not too much serious in frequency and amplitude content.

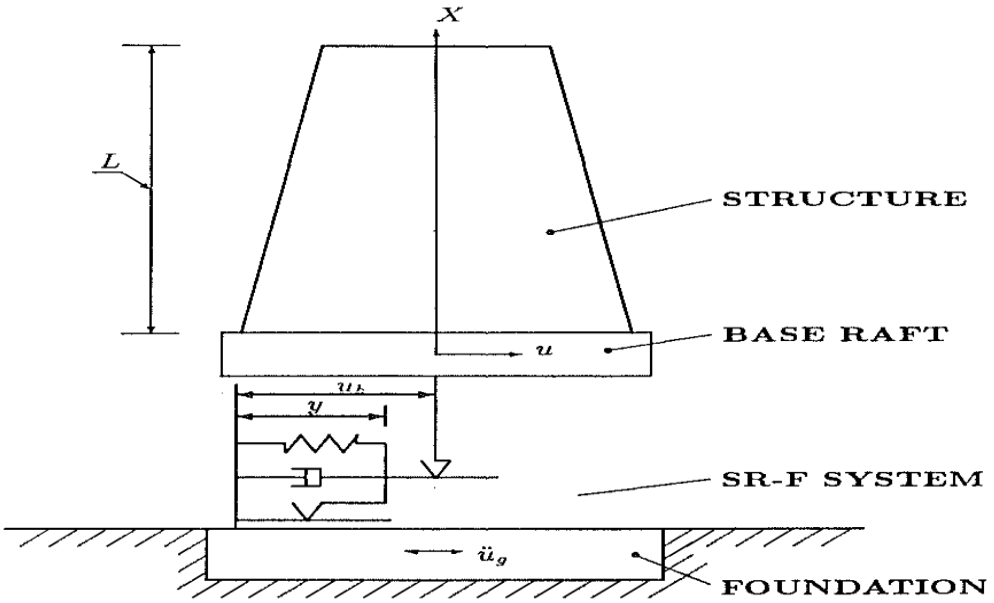

Fig.2: Schematic Diagram of Non uniform Shear-Beam Structure with SR-F Base Isolator

A.N. Lin et al (1992) In this paper, Lin and Shenton presented the seismic results of rigid base and base isolated concentrically brace and special moment resistant steel frames. For the base isolation and fixed base frames, different codes were referred to design. With the help of 1990 structural Engineering Association of California (SEAOC) for recommended design base shear, fixed base frames are designed. Although the base isolated building was designed for 100%, 50% and 25% of SEAOC recommended lateral forces. On-linear time history analysis has been performed for roof displacement, collapsed frames, yielded frames, yielded elements, and total relative roof displacement. The results obtained for different conditions indicate that 50% of SEAOC of the recommended lateral force perform better than other combination. For peak obtained response comparative study was done for fixed and isolated moment resulting braced steel frame.

H.W. Shenton et al (1993) In this paper, Shenton and Lin compared and analyzed relative results of fix based and base isolated structure. Referring the structural agencies Association of California (SEAOC), the concrete fix base structure was designed and it is compared to a fixed base response. According to the SEAOC recommendation, the base shear was varying. Three various type of time history, post-earthquake record were selected to perform nonlinear dynamic analysis for fixed base and base isolated structure. Results were compared to 25% and 50% of the specified lateral force by SEAOC and the performance of building was checked for various lateral forces.

Todd W Erickson et al (2010) In this paper, Erickson and Altoontash discussed that the response of the industrial structure was presented under seismic forces and building was designed according to IBC code. The present study shows that three industrial buildings rest on one isolation slab. All problems related to analyses, design, placement of isolator are comparatively examined.

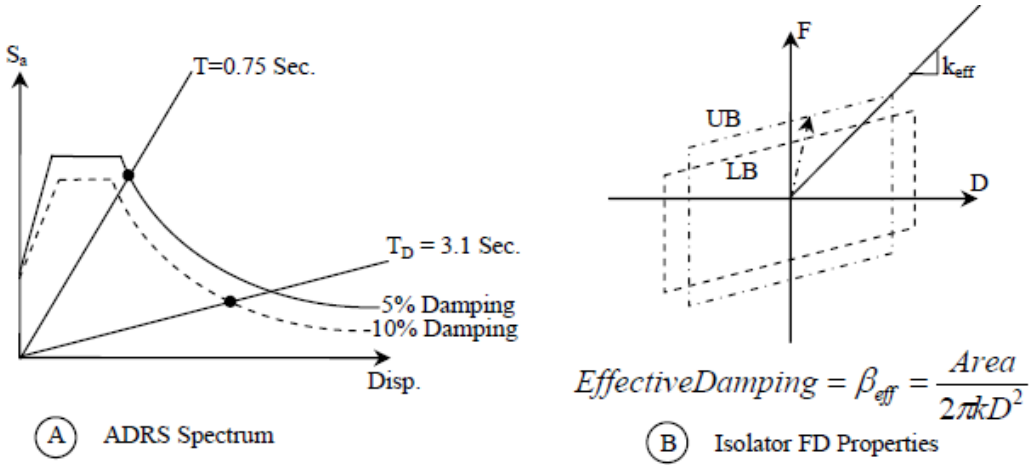

Fig. 3: Acceleration Displacement Spectrum and Isolator Damping

Donato Concellara et al (2013) In this paper, Donato Concellara et al describe the difference between lead rubber isolator and friction slider. Isolator was composed of lead rubber bearing in combination with friction slider (FS) and was named as high damping hybrid seismic isolator. The seismic response of high damping hybrid seismic isolator was the difference with lead rubber isolator response. Under different seismic activity in the form of frequency and intensity, the same structure was examined. The Paper is basically a composite centered on HDSI, compared to lead rubber isolator. Various seismic activities were taken into account and results were compared as in the form of base shear, shear force, displacement at the base of the super structure. The comparative result shows HDHSI gives superior safety for severe seismic activity than other.

J. Enrique Luco et al (2014) In this paper, J. Enrique Luco discussed that the determined the interaction effect of soil structure on the base isolated building. The results show that the deformation of an inelastic structure is high when the effect of soil is taken into account. When the interaction of the structure of the soil was ignored, an undammed vibration was considered, critical harmonic excitation occurs after which the behavior of structure and isolator was uneven. Obtained results depend upon the damping of the isolator. Keeping in view SSI, the resonant response of isolator and superstructure has been increased.

Y. Li et al (2014) In this paper, Y. Li and J. Li showed in the paper about base isolator with variable stiffness and damping, modeling design and experimental testing of the new isolator. Sometimes the impact of earthquakes is so serious that the passive nature of rubber is not able to generate energy due to seismic. So smart base isolation with adaptive and controllable properties was developed with different stiffness and damping properties of the isolator. In this paper describe that the design and experimental testing, dynamic modeling of smart rubber.

M.K. Shrimali et al (2015) In this paper, M.K. Shrimali et.al discussed that the use of control devices for a seismic vulnerability is increasing rapidly. This study focuses on hazardous reason due to pounding effect of nearby buildings. For decreasing this damage use of controlled devices has become essential. The study based on comparative analysis of damper and isolated system. Further studies have said that the hybrid system of control of seismic hazard gives better results than semi-active control. Again given more concentration to know the different parameter of control devices.

III. CONCLUSION

Based on the above study it is clear that the performance of fixed base and isolated base structure depends on the type of underlying soil on which the structure rests. For hard strata, the response is relatively satisfactory but the soil of soft soil increases the acceleration, so the energy dissipation of the structure decreases and the frequency increases. For low to medium height buildings, the efficiency of isolators is good. The response of the structure is different because of the different types of changes due to the changes in physical properties of an isolator.

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