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Study of G+10 RCC Structure using Lead Rubber Bearing and Steel Bracings

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Abstract: ***The effects of an earthquake can be very dangerous for structures under the influence of these forces. There are many traditional methods of protecting structures from the effects of earthquakes. But these methods have some disadvantages. Increasing strength and stiffness are just some of the traditional methods. However, they lead to higher cross sections and result in an uneconomical design. In order to overcome these disadvantages associated with the traditional method, a number of vibration control measures, called structure control, have been investigated and considerable progress has been made in recent years. The article describes the effect of using steel spacers, dampers and base insulation (lead rubber mounts) in a structure subjected to seismic motion. The structure is designed in ETAB, then the spacers, shock absorbers and base insulation are each applied to 3 different models and the results compared. Ground moving force or seismic force is applied to the structure using the seismic coefficient method. The isolated base structure offers better seismic resistance than traditional designs. The basic properties of the basic insulation system are insulation, energy dissipation and recovery mechanism. It has been shown that all basic isolators under design conditions can significantly reduce the acceleration transmitted to the structure. Spacers and dampers are also useful to limit table drift and base shear.***
Keywords: FEM, base shear, displacement, story drift.

I. INTRODUCTION

For the seismic design of structures, the traditional method has long been widely used, i. e. the reinforcement of the rigidity, resistance and ductility of the structure. As a result, an increase in structural element size and material consumption is expected, leading to higher construction costs as well as greater seismic responses due to increased structural rigidity. Therefore, the effectiveness of the traditional method is limited. In order to overcome these disadvantages associated with the traditional method, a number of vibration control measures, called structure control, have been investigated and considerable progress has been made in recent years. Structural control is a diverse field of science. Structural control is a current area of research to reduce structural vibrations under loads such as earthquakes and high winds. With regard to different vibration damping methods, structural control can be divided into active control, passive control, hybrid control and semi-active control. The base isolation is a passive vibration control system that requires no external power source to operate and uses the movement of the structure to generate control forces. The application of this technology may keep the building to remain essentially elastic and thus ensure safety during large earthquakes. Since a base-isolated structure has fundamental frequency lower than both its fixed base frequency and the dominant frequencies of ground motion, the first mode of vibration of isolated structure involves deformation only in the isolation system whereas superstructure remains almost rigid. 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. The development of bracing made the construction of the skyscraper possible. The straps are pressure resistant. Perimeter frame bracing must be considered to increase the lateral load-bearing capacity of the structure. When inserting struts into a steel frame, the steel frame acts like a diagonal compression strut and transfers the compressive force to another connection. Differences in column stiffness can affect the fracture mode and transverse stiffness of the bracing.

II. LITERATURE REVIEW

1) *S.M. Kalantari, Naderpour, Vaez (2008)* [1]: Investigated the effect of using two different types of seismic isolators in decreasing the base shear and story shears of structure. Four structural models with 2, 5, 8 and 12 stories for three cases including fixed-base, lead-rubber isolator and friction pendulum isolator with different stiffness have been modeled. All models have been analyzed under earthquake characteristics of Manjil, Naghan, Tabas and Elcentro using a nonlinear finite element program. The results indicate that by using lead-rubber isolators, maximum displacements of stories in low-rise structures have been increased in comparison with fixed-base model. In contrast, in majority of cases, applying the FPS isolators doesn't

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guarantee the displacement requirement. Also by using isolators, number of cycles related to displacement response would be decreased especially in models with lower stories. In short base isolated structures, the decrease in plastic hinge formation percent of elements was much more than in fixed-base structure

2) *C.P. providakis (2008) [2]:* Performed nonlinear time history analyses using a commercial structural analysis software package to study the influence of isolation damping on base and superstructure drift. Various lead-rubber bearing (LRB) isolation systems were systematically compared and discussed for aseismic performances of two actual reinforced concrete (RC) buildings. Parametric analysis of the buildings fitted with isolation devices was carried out to choose the appropriate design parameters. The efficiency of providing supplemental viscous damping for reducing the isolator displacements while keeping the substructure forces in reasonable ranges was also investigated.
3) *Franco Braga, Laterza (2004) [3]:* They had done experimental studies on a series of dynamic snap-back tests. This test was carried out on a residence building in southern Italy at Rapolla (Potenza–Basilicata). The aim of the research was to investigate the seismic behavior of low-rise base isolated structures mounted on rubber bearings only, or with a hybrid isolation system (sliding bearings for isolation and steel rubber bearings to have a re-centering force)
4) *Abdo Irahim Jalali, Narjabadifam (2004)* [4]: Carried out investigation on the effect of superstructure characteristics on performance of multi-story buildings isolated with lead-plug laminated rubber bearings the superstructure characteristics considered at this research were superstructure mass, superstructure stiffness and superstructure damping, which were varied in the range that was compatible with engineering practice. Comparing the study results it has been observed that, there is optimum amount for each of the dynamic properties of the superstructure which will make design criteria achievable in seismic base-isolation of multi-story buildings. To this purpose, five reinforced concrete moment resisting frame buildings with two, five, nine, fourteen and twenty stories were considered. They were designed according to UBC97, in fixed-base form and base-isolated form. Five different amounts for superstructure base-mass were assigned and 25 related models were created. Variations in superstructure stiffness and superstructure damping were considered in the same manner. All of 85 model buildings were subjected to five ground motion records which have been scaled to have PGA = 0.4g. Nonlinear time-history analyses of created models were conducted by using ETABS 8.5.0. Fundamental periods, modal participation factors and base-shears were studied for all of the model buildings. Comparing analysis results in term of base shear variations for different parameters considered, it was concluded that, superstructure characteristics have considerable effect on performance of isolated systems and optimal performance of base isolated multi-story buildings was achievable by modifying superstructure characteristics.
5) *Pan Wen, Sun Baifeng [5] (2008):* Put forward based on codes (seismic code, 2001). For first step in design was base isolator design and to collect basic data for structure. For second step detail design was considered, time history analysis was adopted. Computer software based on above method with user friendly interface, pre-processor, and post-processor was developed for practical engineering design of superstructure and foundation.
6) *K.K. Sangle, Bajoria, Mhalungkar [6] (2014):* Studied the seismic analysis of high rise steel frame with and without bracings. Pattern of bracings can extensively modify the global seismic behavior of the framed steel building. In this paper nonlinear time history analysis is carried out on high rise steel building with natural frequency, natural time period, mode shapes, inter storey drift, and base shear. Further optimization study was carried out to decide suitable type of bracing by keeping inter storey drift, total lateral displacement and stress level within permissible limits.
7) *Keri L. Ryan [7]: (2007)* Studied the system considered is a generic elastic single-bay multistory frame structure supported on an isolation system with a bilinear force-deformation relation. Three, six, and nine-story versions of the superstructure frame are used, each with story height 12 ft and bay width 24 ft.The peak response of the models described previously is determined by nonlinear response history analysis (RHA) to the SAC LA 10% in 50 years suite of motions [Sommerville et. al. 1998], representative of the design basis earthquake in a non near fault region in Los Angeles.
8) *Lin Su [8] (2004):* Made study of combining the desirable features of the EDF base isolator and the R-FBI system, a new base-isolator design was proposed. It was suggested to replace the elastomeric bearings of the EDF base-isolation system by the R-FBI units, i.e., the upper surface of the R-FBI system in the modified design is replaced by a friction plate. As a result, the structure can slide on its foundation just as in the EDF base-isolation system. The behavior of this base isolator, referred to as the sliding resilient-friction (SRF) base-isolation system.

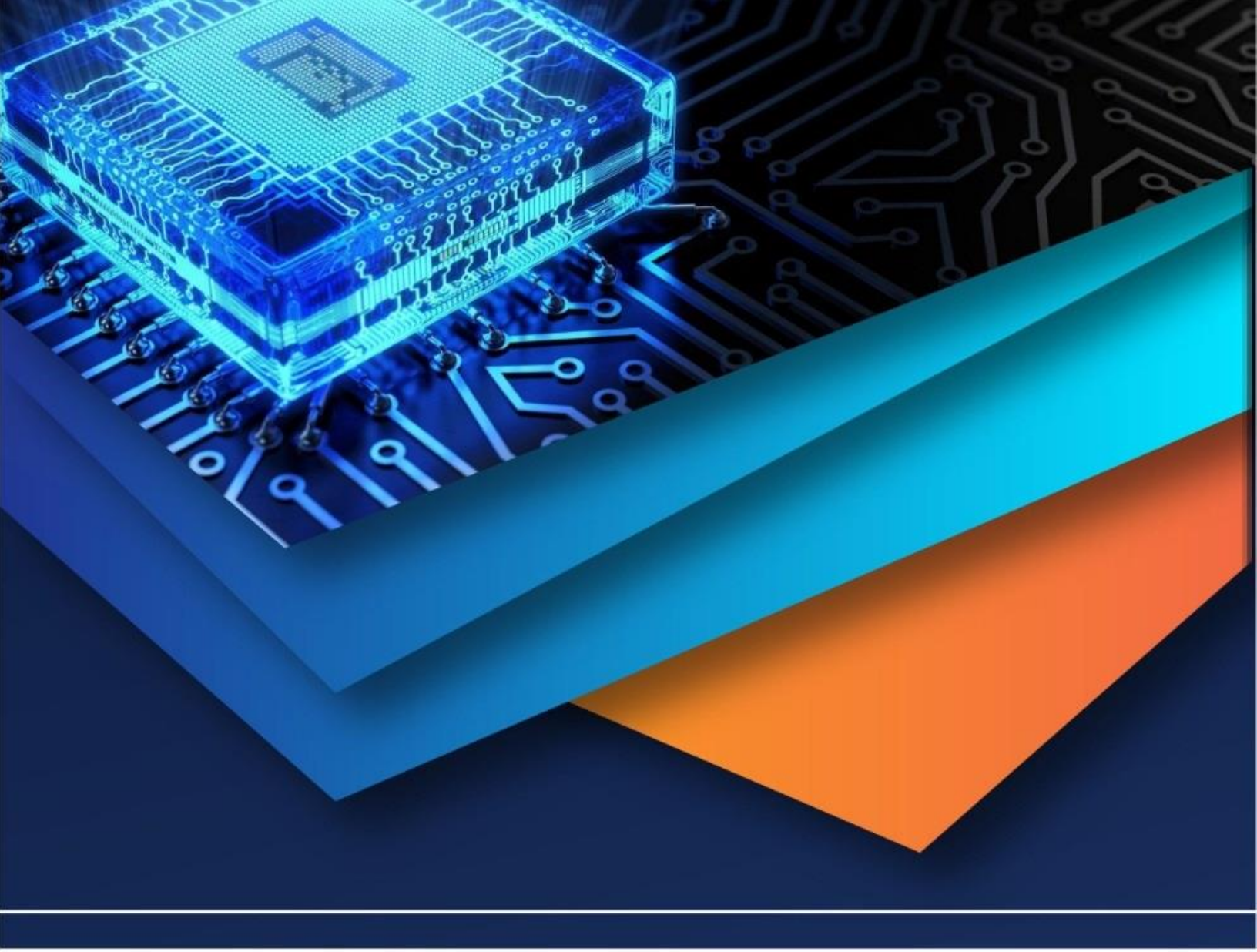
9) *murnal [9] (2004):* The essential characteristics of an effective base isolation system are isolation, energy dissipation, and restoring mechanism. Some friction type base isolation systems proposed earlier have been found to be very effective in reducing the structural response and incorporate simple restoring mechanisms through gravity. However these isolators are effective only under certain excitation and structural characteristics. To overcome these limitations the authors have recently developed a new isolation system called the variable frequency pendulum isolator ~VFPI! that has been found to be very effective under a variety of structure and excitation characteristics. In this paper, the mathematical formulation for the three dimensional behavior of an asymmetric structure isolated by a sliding type isolator, with particular reference to VFPI has been presented.
10) *Su [10] (1989):* Made comparative study of effectiveness of various base isolators is carried out. These include the laminated rubber bearing with and without lead plug and several frictional base isolation systems. The structure is modeled as a rigid mass and the accelerograms of the NOOW component of the El Centro 1940 earthquake and the N90W component of the Mexico City 1985 earthquake are used. The performances of different base isolation devices under a variety of conditions are evaluated and compared. Combining the desirable features of various systems, a new design for a friction base isolator is also developed and its performance is studied. It is shown that, under design conditions, all base isolators can significantly reduce the acceleration transmitted to the superstructure.
11) *Nagajyothi, Ghorpade [11] (2015):* Studied the design of lead rubber bearing system and high damping rubber bearing system for isolated structure for long periods for 5 storey building.
12) *Warn, Ryan [12] (2012):* Have made a review of seismic isolation for buildings and research needs.

III.CONCLUSION

In my study, I have concluded that, the high rise RCC building requires LRB and bracing to seismic effect find out. How to effects of parameters such as base LRB as base isolator and steel bracing, storey drift, storey displacement on RCC buildings. LRB placed as base isolator with bracing and without bracing effective on model.

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