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Review Paper On Vibration Control Of Building Using Lead Rubber Base Isolator

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Abstract:

It has been widely seen that whenever earthquake occurs there is sudden shaking of earths surface due to the release of large amount of strain energy.and the structure experiences shaking or vibrations and results in collapse. So, to overcome such hazard the base isolators is widely used. Base isolator is the technique to reduce the vibrations of building which are provided at base. In this base isolator lead rubber base isolator is more effective. In Lead rubber isolator, lead core provides damping by deforming plastically when isolator moves laterally. LRB may be represented through a bilinear model which can be characterized with three parameters the initial stiffness, post yield stiffness and characteristic strength..

Keywords
Earthquake, Lead rubber bearing ,base isolation.

1. Introduction

It has been widely seen that when earthquake occurs it cause large and intensive shaking of the ground.So the building or the structure of any shape,size of any height will experience the motion at its base.Even the base of structure moves with the ground,but the roof has the tendency to stay in its original position.The building structure is basically made up of vertical and horizontal components i.e.column,beam,roof,etc.will experience the same motion which is caused by earthquake on base and these column and beam will drag the roof slong with them.The tendency of roof to continue in its original position is known as inertia.

The level of damage caused by earthquake on a structure depends on the amplitude and the duration of shaking.The amplitudes are largest with respect to the large earthquake and the duration of shaking generally increases with the size of earthquake.Moreover the regional geology of surface can affect the level and duration of shaking but more important are the local site conditions where the structure is constructed.

When the building is built directly on the ground it will move with an earthquake motion and can sustain to damage.to minimize the vibrations in a building due to earthquake and to protect the building from damage,a building is to built away(isolated)from the ground and will rest on flexible bearings or pads which are known as base isolators.Base isolators protect the building from extreme damage and building only move a little or not at all during the earthquake.This technology can make medium rise masonary (stone or brick)or RCC structure capable of withstanding earthquakes,protecting them and their occupants from major damage or injury.They are not suitable for all types of structures and is designed for hard soil,not on soft soil.

Base isolators is a new technology proposed in 1960.Base isolation is a technique developed to prevent or minimize damage to building during an earthquake.Base Isolators works in a similar way to car suspension,which allows a car to travel over rough ground without the occupants of the car getting thrown around.

Worlds first base isolated structure is the Willian clayton building in Wellington built in 1962 with the use of 80 lead rubber bearings.But this number depends on how engineers wants to distribute the load.Lead rubber bearing appear to be the best isolator to perform functions like horizontal flexibility,rigidity against normal lateral loads.Rubber in isolators act as a spring.LRB consists of three basic components a Leadplug,rubber and steel which are gemerally p;aced in layers.Lead rubber bearings (LRB)consisits of a laminated rubber and steel flange plates for mounting to the structure.Ninety percent of isolators have an energy dissipating lead core.The rubber in the isolator acts as a spring.It is very soft laterlly but very stiff vertically.The high vertical stiffness is achieved by having thin layers of rubber reinforced by steel shims.This two characteristics allow the isolator to move laterally with relatively low stiffness yet carry significant axial load due to their high vartical stiffness.The lead core provides damping by deforming plastically when the isolator moves laterally in an earthquake.The shims of isolators are

cut to exacting tolerances by Laser.The steel mounting plates are machined by computer controlled milling machines that give high production throughout the accuracy.Molding each bearing takes 8 to 48 hours depending on the size of bearing.The curing phase is continuously monitored to ensure that the rubber is uniformly cured throughout the bearing.All steel plates to be bonded are completely dip and thoroughly clean in degreasing agent,apply bonding adhesive primer,and apply bonding adhesive top coat and keep at oven at control temperature before molding.

2. Objectives

Objectives for controlling the vibrations of building due to earthquake are

1. To study the seismic behavior of structure
2. To study different isolation system for controlling the vibration of structure
3. To studt the design methods of LRB for proposed structure
4. To study the parameters of LRB which affects the performance of isolators
5. Comparision of bare frame with the frame using LRB.

3. Literature Review

Yogesh Narayan Sonawane, "Base Isolation for Multistoried Buildings with Lead Rubber bearing", (International Journal of New Innovations in Engineering and Technology, 2016):

The main purpose of this study is to check the behavior of the buildings in seismic zone by using base isolation concept, and reduce the story acceleration, story drift and increase the period of oscillation due to earthquake ground excitation, applied to the superstructure of the G+8 building by installing base isolators like lead rubber bearing (LRB) at the foundation level then compare the performance between the fixed base condition and base isolated condition by using SAP software. seismic base isolation technology to building models, the story accelerations are reduced significantly. Story drift can be reduced in base isolated buildings.

R. S. Jangid,(Optimum lead–rubber isolation bearings for near-fault motions)Department of Civil Engineering, Indian Institute of Technology Bombay:

In this paper analytical seismic response of the multi-story buildings isolated by the lead–rubber bearings (LRB) under near-fault motion were investigated. The increase in the bearing yield strength can reduce the bearing displacement significantly without much altering to the superstructure accelerations. The LRB with higher yield displacement (i.e. soft bearings)perform better than the bearing with low yield displacement was observed. the bearing displacement decreases significantly.also with the increase of yield strength around the particular yield strength.alsothe optimum yield strength of the LRB based on thecriterion of minimization of both top floor absolute acceleration and bearing displacement is found to be in the range of 10%–15% of the total weight of the building under near-fault motions. However, the bearing displacement at optimum yield strength increases with the increase of the flexibility of the bearing and the superstructure.

H. R. Tavakoli . F. Naghavi . A. R. Goltabar," Dynamic Responses of the Base-Fixed and Isolated Building Frames Under Far- and Near-Fault Earthquakes", (RESEARCH ARTICLE - CIVIL ENGINEERING):

In this execution executed by nonlinear time history analysis method for reinforced-concrete two-dimensional building frames. it were observed that displacements are much higher in the isolated models than the fixed-base models, especially in the lower floors of each model due to the flexibility provided by the isolators in the base of buildings.also less displacement in top story of the base-isolated compared with base-fixed models due tosmall deformation of floors relative to each other. Increasing the number of the building floors increases base shear values in both the base-isolated and base-fixed buildings. cceleration of the top story in base-isolated buildingsis lesser than base-fixed buildings. Floor accelerations decrease in the middle floors more than the base and top floor. Absolute acceleration of the base floor does not change much by utilizing LRB isolation systems in the near-fault motions. Displacement values in the near-fault excitations are considerably more than far-field motions in both the fixed and isolated base of all models. These values also increasewith increasing number of building floors.

Kishan Bhojani,Vishal B. Patel and Snehal V. Mevada,"Seismic Vibation Control of Building with Lead Rubber Bearing Isolator" (Kalpa Publications in Civil Engineering ICRISET2017. International Conference on ReSearch):

Observes in this paper a nonlinear time history analysis is carried out for reinforced concrete building by use of computer tool SAP 2000 by Anilduke and Khedikar. For the different values of damping corresponding displacement and acceleration values are increase in damping, the

displacement and acceleration of building reduces observed that the rate of decrease of response is significant up to the damping of 1300 kN-s/m and then the effect remains constant. The percentage reduction in acceleration in x-direction and y-direction is 76% and 74% respectively. It is observed that the Lead Rubber Bearing isolator is quite effective in reducing the displacement and acceleration of building.There exists the optimum value of damping of isolator.The isolator is found to be effective in reducing the base shear of building.

Manasa M S , Dr. Alice Matha,(Performance of Lead Rubber Bearing as a Base Isolator) IJSTE May2017):

The two models of lead rubber bearing and laminated rubber bearing with lateraldisplacement of 52mm without failure were analyzed in this study.he concluded that The non-linear static analysis of laminated and lead rubber bearings done in ANSYS Finite Element package shows that the performance of lead rubber bearing is better than the conventional laminated rubber bearing. The higher energy dissipation capability of lead rubber bearing is due to the plastic deformation of lead core which deforms even under small shear stress whichmakes it suitable in strong earthquake regions. The lead readily transform to the plastic state because of the very small yield stress about 10 MPa. The laminated rubber bearing showed a linear shear force-displacement curve without much hysteresis. It also undergone a lateral displacement equivalent to lead rubber bearing which makes it suitable near low-moderate earthquake regions.The ratio between the elastic and post yield stiffness of lead rubber bearing in this numerical analysis goes well with the theoretical value which shows that the presented finite element simulation could accurately capture the behaviour of bearings.

4. Results

This study presents investigation for buildings subjected to earthquake induced load with fixed base and with lead rubber bearing base isolated structure subjected to seismic ground motion.

5. Conclusion

As Lead rubber bearing combines the functions of vertical support,rigidity at service load,and horizontal flexibility it represents an economic solution for seismic isolation problems.Lead behaves like an elastic-plastic solid when it yields at low stress around 10mpa.Lead has good fatigue properties during cycling at plastic strains.Holes can be made in the steel plates and rubber sheets before they are joined together.Determination of yield force of the lead inserted can be done from the yield stress of the lead in the bearing.

6. References

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