Parametric Study on Effect of Isolator Characteristics, and seismic Performance of Building

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Abstract- *The concept of protecting a building from the damaging effects of an earthquake by introducing some type of support that isolates it from the shaking ground is an attractive one and many mechanisms to achieve this result have been proposed. Although the early proposals go back 100years, it is only in recent years that base isolation becomes a practical strategy for earthquake resistant design. In this chapter we study the dynamic behavior of buildings supported on the base isolation system with limited objective of understanding why and under what condition isolation is effecting in reducing the earthquake induced force in a structure.*

The use of isolator is lead rubber bearing to reduce the effect the seismic forces and increase deformation of the base isolation. The parameter to study for the study of isolated structure are story displacement, acceleration, inter story drift and absorbed energy.

Compare Storey displacement, Story shear, and Storey drift fixed base building compare with LRB isolator building Make model of RCC building with G+5, G+7, G+9 and G+ 12 for different without and with wall load. And analysis is done with response spectrum method and Time History Method in Etab software.

Keywords- LRB isolator, RC Building, Response Spectrum Analysis, Displacement, Storey Drift, Base Shear.

I. INTRODUCTION

For many structures, earthquake load is the most significant dynamic load. Response to this dynamic load plays an important role in the overall design of structures. Structural designers‘ efforts are directed towards reducing the dynamic response of structures. There are two approaches to enhance resistance of structures against seismic loads:

1. Enhancing capacity of structural components:

In this approach, the magnitude of seismic forces that could act on the structure, in case of an earthquake of an accepted level, is determined. The demand on the various components is evaluated, and the components are proportioned to have a capacity sufficiently higher than the demand.. .

2. Reducing the demand on the structural components:

Seismic demand of a structure depends on certain characteristics of the structure. Some modification in these characteristics can reduce the seismic demand. In this approach, such a modification is made, and the demand on the structure is ensured to be sufficiently lower than the capacity of the structure. Much of the research work has been done towards development of such devices which control the response and seduce seismic demand.

II. LITERATURE SURVEY

Ounis Hadj Mohamed, Ounis Abdelhafid (AJCE-2013) [1]:

In order to illustrate the effect of damping on the response of a base-isolated building, a large investigation is made. It consists in a parametric study which takes into account the progressive variation of the damping ratio (10% to 30%) under different nature of seismic excitations (near and far field). A time history analysis is used to determine a response of the structure represented in this case by terms of relative displacements and inter-stories drift at various levels of the building, additionally a strong deviation of energy capacity by the LRB (Lead Rubber Bearing) system will be recorded, therefore the results show that the efficiency of the isolator increases with the assumed damping ratio, provided that this latteris less or equal to 20%. Beyond this value, the isolator becomes less convenient.

The relative displacement of the floor to terrace is greatly reduced, at a rate of approximately 65% for all excitations except for that of Elcentro. Therefore, the LRB system is most appropriate at a damping rate of 20%. We observe that the inter-story displacement depends mainly on the nature of the seismic excitation.

The average displacement reduction is estimated at 40% for high damping rates under the Elcentro excitation; in contrast, there is a strong reduction of the inter-story displacement (65 and 70%) at a low damping rate (10%) under the excitations of Lexington and Oakwhaf, respectively.

Moreover, we record for these two excitations a perfect coincidence of the two curves at different damping rates (10 and 30%). A high attenuation (estimated at 61%) was observed for the excitation of Sylmarff even at a low rate of depreciation (10%), even though this excitation is characterized by high PGA (0.604 g).

Therefore, the LRB isolator with a low damping rate (10%) reduces the inter-story displacement, on average by 65%. The isolator LRB plays a major role for which it has been designed, this results on the one hand by the increase in the surface of the hysteresis curve, and, on the other hand, by a high energy absorption estimated at an average rate of 65% for an optimum damping rate of 20%. This indicates the major effect of LRB isolator as an energy absorber.

KAAB Mohamed Zohaïr, OUNIS Abdelhafid. (IJCSE 2011) [2]:

The use of the base isolation device LRB (Lead Rubber Bearing) allows the control of the deformations which are localized on this last, and also allows carrying out a satisfactory compromise between the reduction of the seismic forces and the increase in the deformations of the base isolation. Therefore, a parametric study on the effective damping of the isolation system carried out in this work has allowed the evaluation of the influence of the damping of this seismic base isolation system on the dynamic response of the isolated structures in term of displacement, acceleration, interstory drift and absorbed energy.

The results of the seismic response obtained by the parametric study on the effective damping of the seismic isolation system LRB have allowed us to deduce that the displacements of the superstructure and the isolation system decrease with the increase of the effective damping under all the seismic loadings used, the accelerations transmitted to the superstructure increase for a weak effective damping and on the other hand they are reduced for an average or high damping and the interstory drift under all the seismic loadings used are generally reduced with the increase of the percentage of the effective damping. We can also conclude that the energy absorbed by the seismic isolation system increase in agreement with the increase of the effective damping of this system.

Sunita Tolani, Dr. Ajay Sharma. (AJER-2016) [3]:

The structural system considered for analysis is a three storey reinforced concrete building, which is idealized as a shear type building with one lateral degree of freedom at each floor level. The isolation systems considered for this study are Laminated Rubber bearing (LRB), Lead Rubber Bearing (N-Z bearing) and Friction Pendulum System (FPS).

This study yielded following results:

(1) Top floor absolute acceleration, inter-storey drift and base shear are very less in base isolated building in comparison to corresponding response of fixed base building which indicates reduction of earthquake induced forces in structure and ensures safety of structural and nonstructural components of the building.

2. In Base isolated building having LRB system,

(i) Increase in the period of isolation increases the bearing displacement but decreases the superstructure acceleration.
(ii) Increase in isolator damping decreases both the bearing displacement and the superstructure acceleration.

3. In Base isolated building having NZ System,
(i) Increase in the period of isolation increases the bearing displacement but decreases the superstructure acceleration. However, the response is not much influenced by isolation period.
(ii) Increase in isolator damping decreases both the bearing displacement and the superstructure acceleration.
(iii) Increase in the Normalized Yield Strength (F0) decreases the bearing displacement but increases the superstructure acceleration.

4. In Base isolated building having FPS,

(i) Increase in the friction coefficient (μ) decreases the bearing displacement but increases the superstructure acceleration.
(ii) Increase in the period of isolation increases the bearing displacement but decreases the superstructure acceleration.

III. GRAPHICAL RESULT

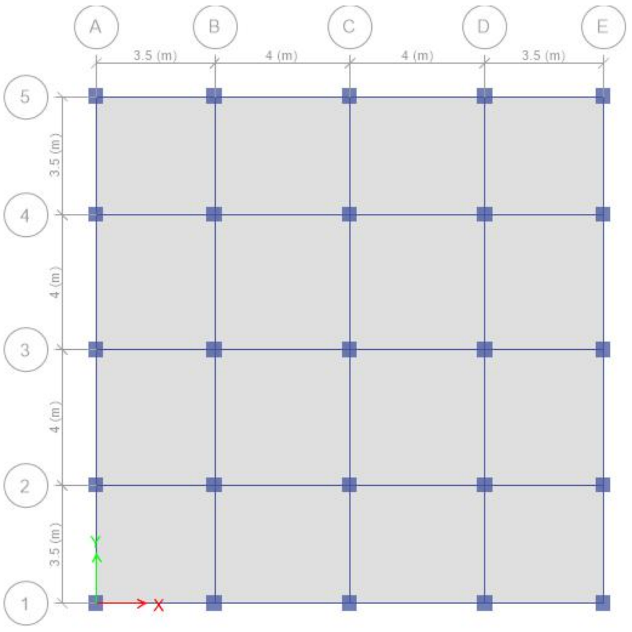

Fig:G+5 Story Building

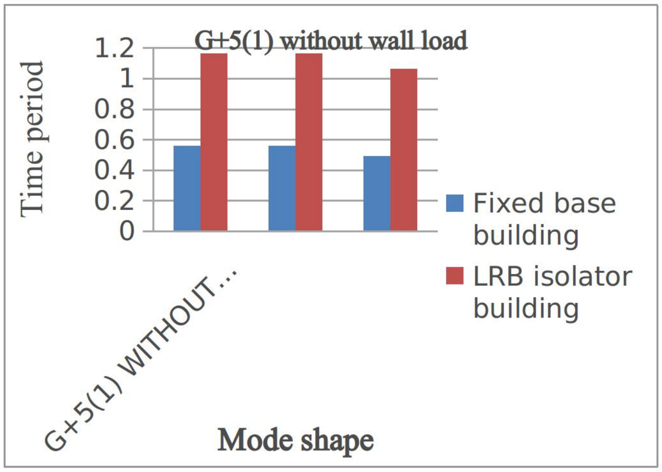

Fig: Time period trough analytical for G+5 building without wall load

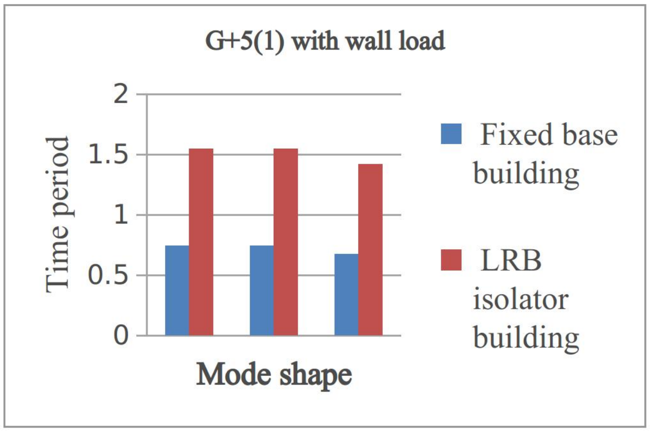

Fig: Time period trough analytical for G+5 building with wall load

G+5 WITH WALL LOAD

Keff	Tb	B	P	Cb	Fy
1740.3	1.46	370	925	58.03	37.9
Db	Dl	Tr	Kd	Ku	ti
360	70	100	1078	10189	8

G+5 WITH WALL LOAD

Keff	Tb	B	P	Cb	Fy
1547.55	1.14	260	499	57.67	31.9
Db	Dl	Tr	Kd	Ku	ti
250	65	80	650	7653.5	8

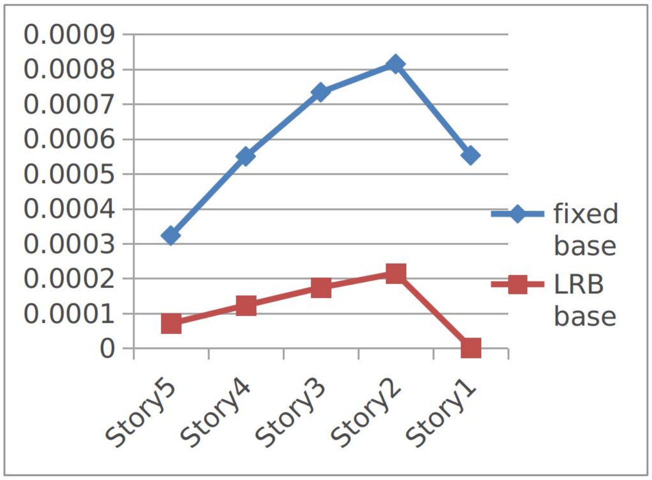

Fig: Story Drift trough analytical for G+5 building without wall load

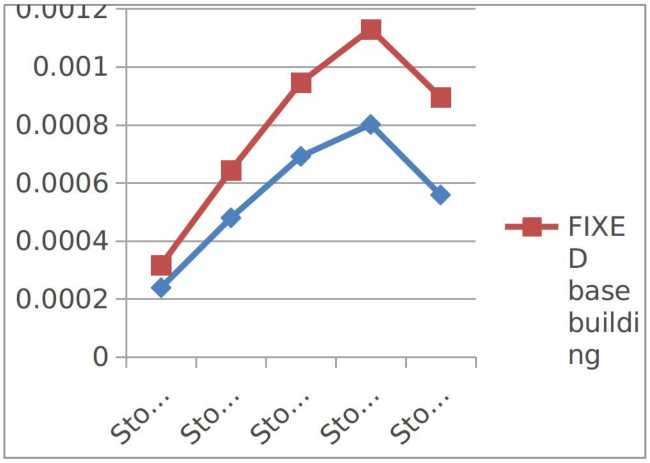

Fig: Story Drift trough analytical for G+5 building with wall load

III. CONCLUSIONS

From the above case study we conclude that the reduction of story drift in LRB base isolator correspond to fixed base building.

The time period of fixed base building is lower compare to LRB base isolator building.

The story stiffness is higher in fixed base building compare to LRB isolator base building

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