COMPARATIVE STUDY ON FIXED BASE AND BASE ISOLATED FOR BUILDING ON SLOPING GROUND

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Abstract – Building on sloping ground one of the factors which reduces the capacity of the Structure due to the fact that the column in the ground storey are of different heights which leads to combination of Short column and long column. In this G+ 9 storey RCC building and the ground slope varying from 0° to 30° have been considered for the analysis and comparison has been made, The modeling and analysis of the building has been done by using structure analysis tool ETAB and the lead rubber bearing is considered to study the effect of building on sloping ground with base isolation and without base isolation during the earthquake. The results have been compared with the results of the building with and without base isolation. The seismic analysis was done by linear static analysis and the response spectrum analyses have been carried out as per IS:1893 (part 1): 2002. The results were obtained in the form of top storey displacement, drift, base shear and time period.

Key Words: Base isolation, sloping ground, Hilly area, led rubber.

1. INTRODUCTION

Generally the structures are constructed on level ground. In some areas the ground itself is a slope. In that condition it is very difficult to excavation, leveling and it is very expensive .Due to the scarcity of level ground engineers started construction on sloppy ground itself. Some of the hilly areas are more prone to the earthquake and it is one of the most dangerous natural hazards. Earthquake occurs due to sudden movement of the tectonic plates as a results it release large amount of energy in a few seconds. The impact of this function is most harmful because it affects large vicinity, and which occurs sudden and unpredictable. It causes large scale loss of life and property and damages important services such as, sewerage systems, communication, power, transport and water supply etc. They not only destroy towns, cities and villages, but the result leads to weaken the financially viable and social structure of the country. To defeat from the problem we need to find out the seismic performance and lateral stability of the building structure.

2. OBJECTIVES

- To analyze and study the effectiveness of lead rubber bearing used as base isolation system
- To study the existing literatures on different structures by use of base isolated and non-base isolated structures.
- To carry out comparison between fixed base and base isolated building on the basis of their dynamic properties like, base shear, storey drift, time period, storey displacement,

2. METHODOLOGY

The six models of a building (g+9) are considered based on on their slope with base isolation and without base Isolation with slope 0°,10°,20°,30°, After modeling of structures in ETABS software, their response is studied under response spectrum and compared with load combination as envelope max and min by considering storey drifts, storey shear ,storey displacement ,time period ,maximum bending moment ,base reaction.

Model 1: fixed base building for G+9 storey with slope 0°

Model 2: fixed base building for G+9 storey with slope10°

Model 3: fixed base building for G+9 storey with slope20°

Model 4: fixed base building for G+9 storey with slope 30°

Model 5: lead rubber bearing building for G+ 9 storey with slope 0°

Model 6: lead rubber bearing building for G+9 storey with

Slope 10°

Model 7: lead rubber bearing building for G+9 storeys with

slope 20°

Model 7: lead rubber bearing building for G+9 storeys with slope 20°

3.1 Material model

The parameters considered for G+9 storey buildings are as follows:

Table1: Building properties

Storey	G+9
Beam size	230 x 650mm
Floor height	3.2
Wall thickness	200
Column size	500x500m m
Slab thickness	150mm
Live load on the slab	2kN/m2
Floor finish	1 kN/m2
Grade of Concrete	M30
Grade of Steel	Fe500
Yield Strength of Steel,	500000 kN/m2

3.2 Properties of Rubber Isolators

Table2: Properties of lead rubber bearing

	U1	*U2*	*U3*
Linear effective stiffness Kn/m	15000 0	800	800
Nonlinear stiffness (kN/m)		2500	2500
Yield Strength (kN)		80	80
Post yield stiffness		0.1	0.1

3.3 Building Model And Elevations

Fig-1: plan view of building

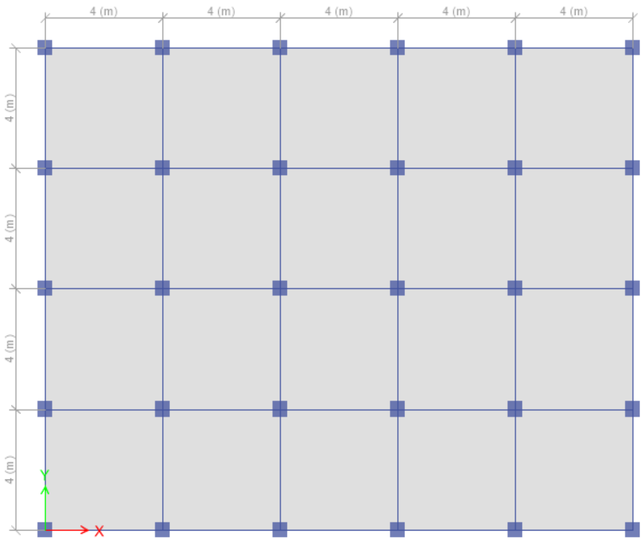


Fig-2: Z-3d view of building

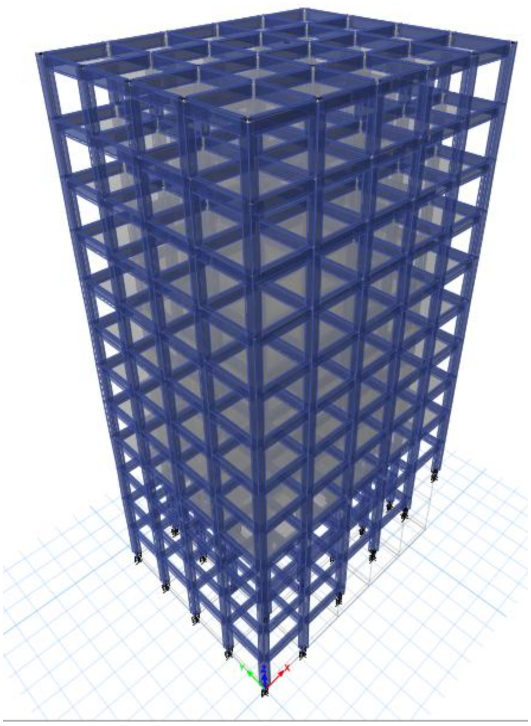


Fig-3: 0° Slope for fixed base

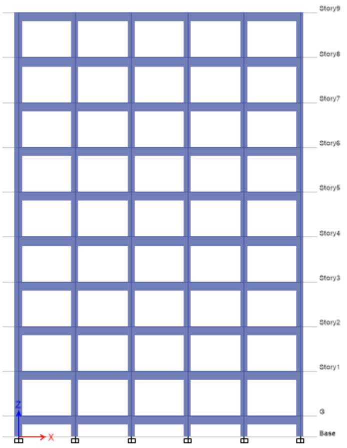


Fig-4: 20° Slope for fixed base

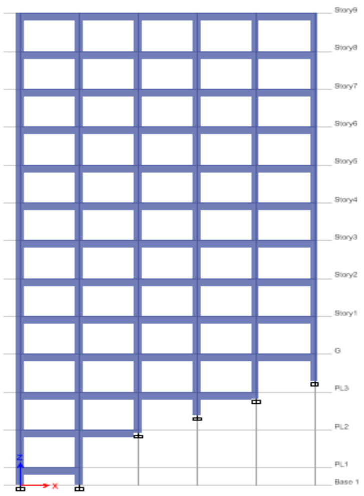


Fig5: 10° slope for fixed base

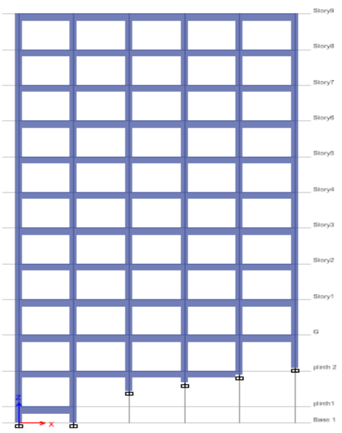


Fig6: 0° slope for lead rubber

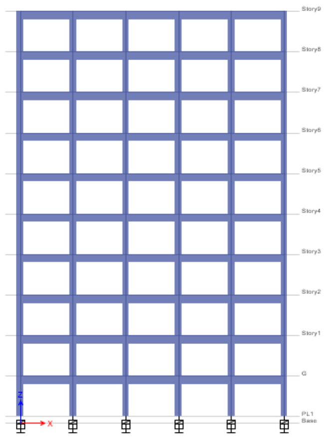


Fig7:30° Slope for fixed base

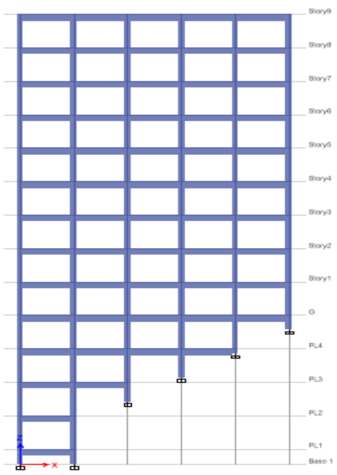


Fig8:10° Slope for lead rubber

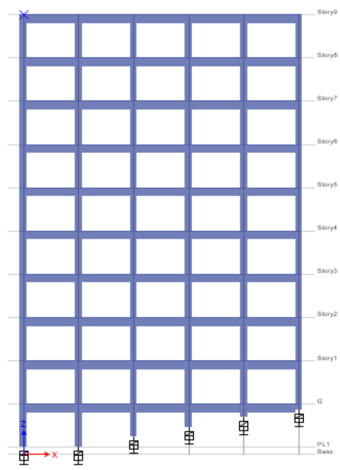


Fig9:30° Slope for lead rubber

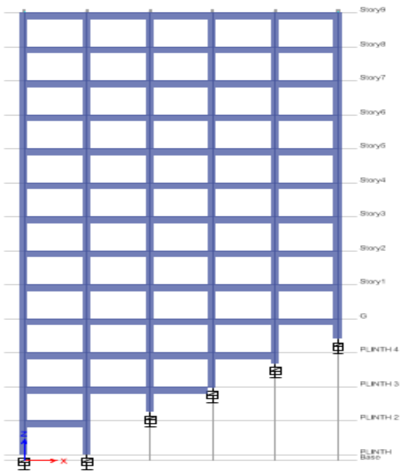
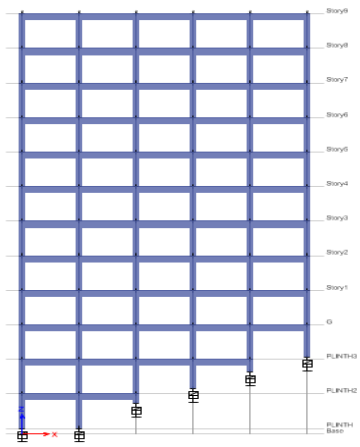


Fig10:20° Slope for lead rubber



4. ANALYSIS REULTS FOR FIXED BASE

4.1 Storey drifts

Fig11: Storey drifts in x-direction

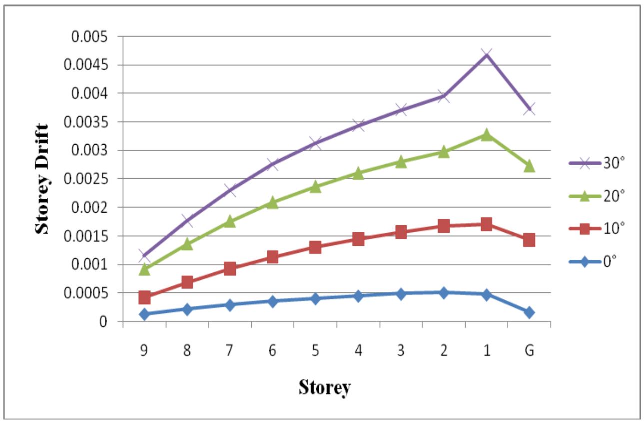
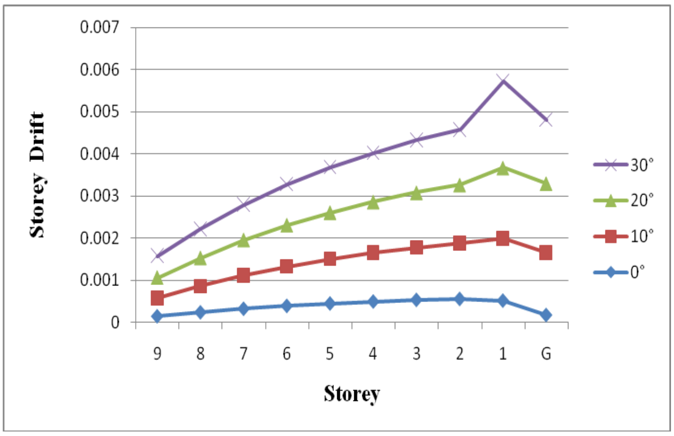


Fig12: Storey drifts in y-direction



4.2 Storey Displacement

Fig13: Storey displacement in x-direction

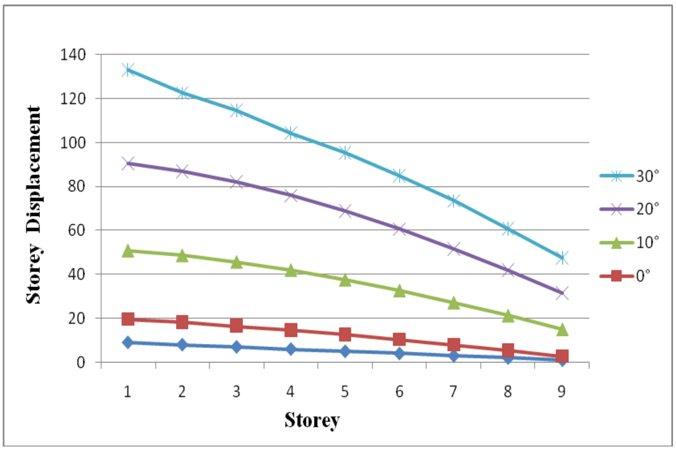
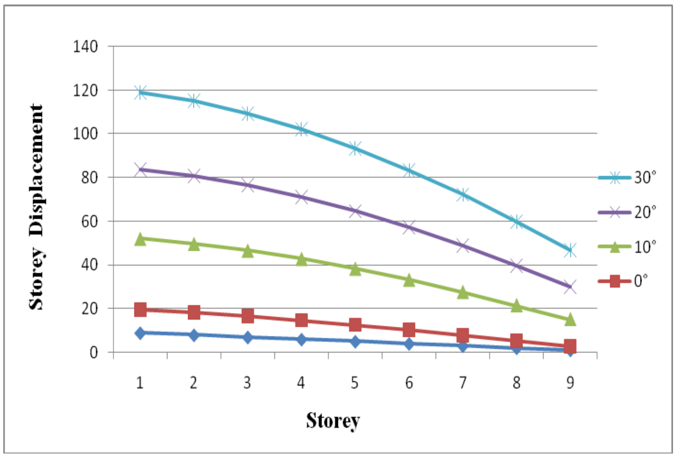
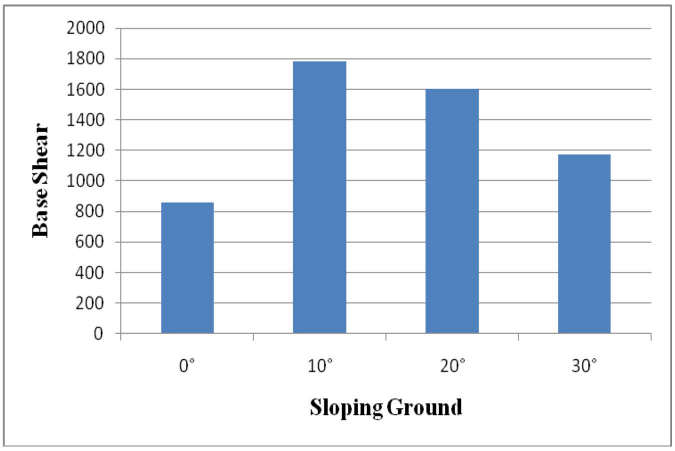


Fig14 : Storey displacement In y-direction



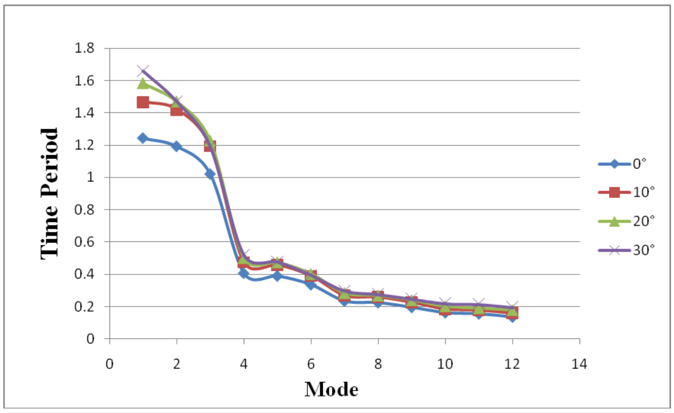
4.3 Base Shear For Fixed Building

Fig15: Base shear for fixed base



4.4 Time Period

Fig16: Time period for fixed base



5. ANALYSIS REULTS FOR LEAD RUBBER BASE

5.1 Storey drifts

Fig17: Storey drifts in x-direction

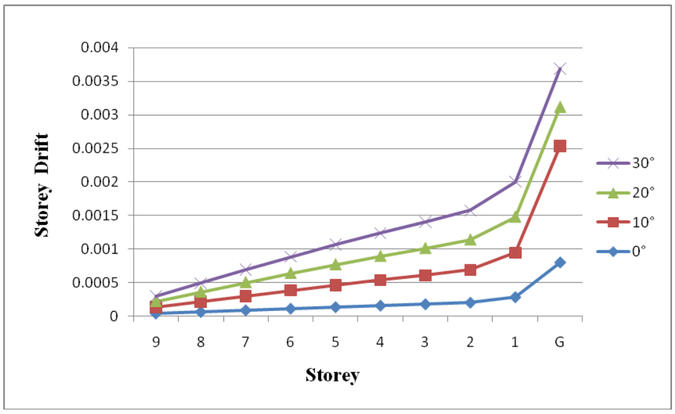
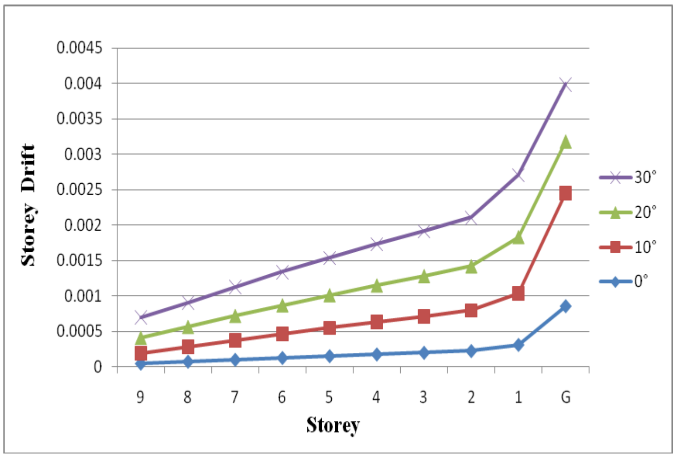
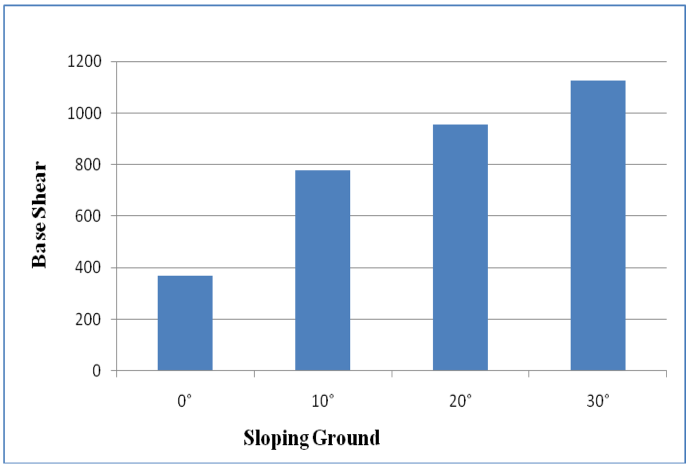


Fig18: Storey drifts in x-direction



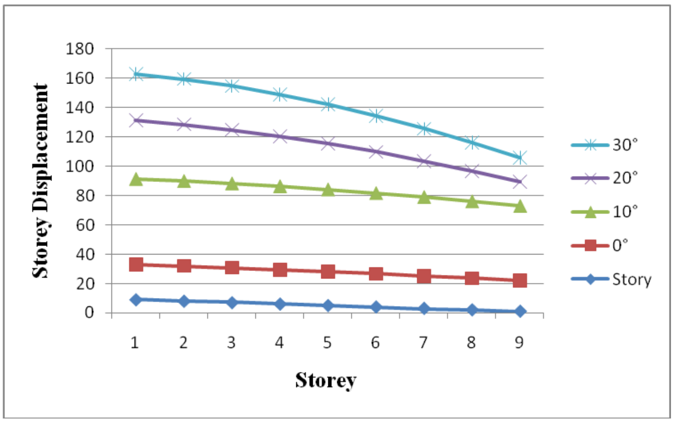
5.2 Base Shear

Fig19: Base shear for lead rubber base



5.3 Time period

Fig20: Time period for lead rubber base



5.4 Storey Displacement

Fig21: Storey displacement in x-direction

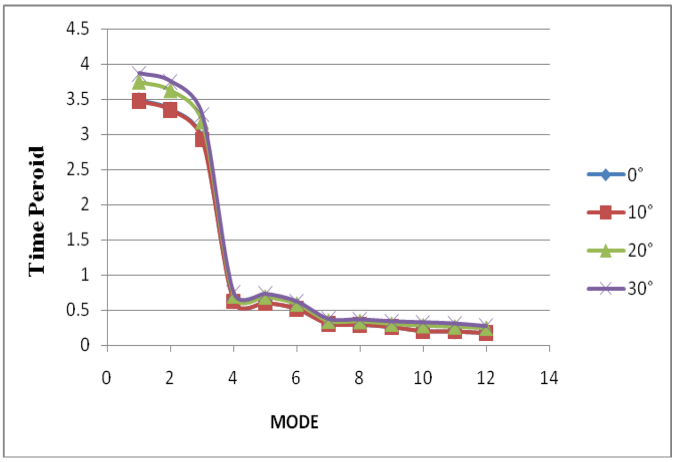
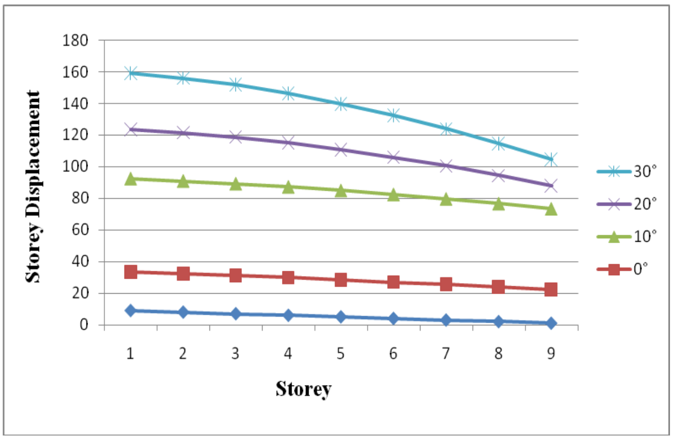


Fig22: Storey displacement in y-direction



5. CONCLUSION

- Base isolation devices increases storey drift due to increase in storey displacement, also it can be concluded that as ground slope increases storey drift decreases
- Decreases the base shear averagely by 55% as ground slope increases from 20˚ to 30˚, Thus there is no requirement of providing shear wall, bracing and ductile detailing for beam column joint Time period increases 2.65 times in isolated base structure compared to fixed base structures on sloping Ground
- By providing base isolation device at different level in the building on sloping ground from results it can be concluded that base isolation at foundation level gives more efficient results as compared to other position
- By providing led rubber base isolation the displacement in base isolated buildings resting on 0°, 10°,20°, and 30° ground slope were increases 2.14, 2.42 and 2.82 times more respectively as compared to fixed base buildings.
- When compare the design LRB isolator and base reactions for 0°,10°,20°,30 sloped ground, it conclude that the base isolation device (LRB) is suitable for low to medium rise buildings.

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BIOGRAPHIES

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