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NONLINEAR STATIC ANALYSIS OF 3-D RC FRAMED ASYMMETRIC BUILDING WITH LEAD RUBBER ISOLATOR USING SAP2000V19

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ABSTRACT:-Many buildings in the present scenario have irregular configurations both in plan and elevation.This in future may be subjected to devastating earthquakes. So it is also necessary to enhance the seismic performance of asymmetric buildings by using seismic control techniques. In the present study a total of 9 models, asymmetrical in plan (L-shape) are taken for analysis to cover the broader spectrum of low, medium & high rise buildings for the seismic control of the structures using pushover analysis, two different techniques were considered such as lead rubber bearing isolator and masonry infill walls, the analysis has been carried out using SAP2000V19. The results of bare frame and other building models have been compared, the presence of lead rubber base isolator, top story drift get reduced as compared with masonry infill wall. The trend was found to be reversed for high rise buildings especially with the application of isolation systems due to the massive increase in the story displacements suggesting the ineffectiveness of the base isolators for high rise buildings successively the plastic hinge pattern formed after carrying out the pushover analysis was also studied which indicated that structural performance was considerably improved.

1.1 BACKGROUND

For seismic design of building structures, the traditional method, *i.e*., strengthening the stiffness, strength, and ductility of the structures, has been in common use for a long time. Therefore, the dimensions of structural members and the consumption of material are expected to be increased, which leads to higher cost of the buildings as well as larger seismic responses due to larger stiffness of the structures. Thus, the efficiency of the traditional method is constrained. To overcome these disadvantages associated with the traditional method, many vibration control measures, called structural control, have been studied and remarkable advances in this respect have been made over recent years. Structural Control is a diverse field of study. Structural Control is the one of the areas of current research aims to reduce structural vibrations during loading such as earthquakes and strong winds.

INTRODUCTION

Base isolation is a technique developed to prevent or minimize damage to buildings during an earthquake. It has been used in New Zealand, as well as in India, Japan, Italy and the USA.

A fixed-base building (built directly on the ground) will move with an earthquake's motion and can sustain extensive damage as a result. When a building is built away (isolated) from the ground, resting on flexible bearings or pads known as base isolators, it will only move a little or not at all during an earthquake.

The isolators work 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.

Base isolation technology can make medium-rise masonry (stone or brick) or reinforced concrete structures capable of withstanding earthquakes, protecting them and their occupants from major damage or injury. It is not suitable for all types of structures and is designed for hard soil, not soft.

1.7 OBJECTIVES

Following are the main objectives of the work:

1. The main objective of the present work is to study the effect and variation of Building under application of Rubber Isolator for three categories of buildings Low Rise Buildings, Medium Rise Buildings, and High Rise Buildings.
2. In the present study the application of Rubber Isolator on typical multi-storied Buildings was done by Push over analysis is studied
3. In the present work, multistory buildings of 6 storeys, 11 storeys and 16 storeys were modeled with and without using Rubber Isolators.
4. The analysis of the building has been carried out using SAP2000 V19 and the Push over analysis method.
5. The results from the models are compared with general buildings in different types of story buildings (low, medium, high rise buildings).

DESIGN CONSIDERATIONS AND MODELING OF BUILDING IN SAP

4.1 MODELS FOR DESIGN

LOW RISE BUILDING

G+5 Design details	
Type of structure	RCC frame structure
Number of stories (G+5)	6 Stories
Story to story height	3m
Ground story height	3.0m
Building height	3+3*5=18
Grade of concrete	M30 for columns, Beams and slab
Thickness of slab	0.12m
Beam size	0.4mX0.4m
Column size	0.6mX0.6m
Density	For concrete 24kN/m^3

MEDIUM RISE BUILDINGS

G+10 Design details	
Type of structure	RCC frame structure
Number of stories (G+5)	6 Stories
Story to story height	3m
Ground story height	3 m
Building Height	3+10*3=33m
Grade of concrete	M30 for columns, Beams and slab
Thickness of slab	0.12m
Beam size	0.4mX0.4m
Column size	0.6mX0.6m
Density	For concrete 24kN/m^3

HIGH RISE BUILDING

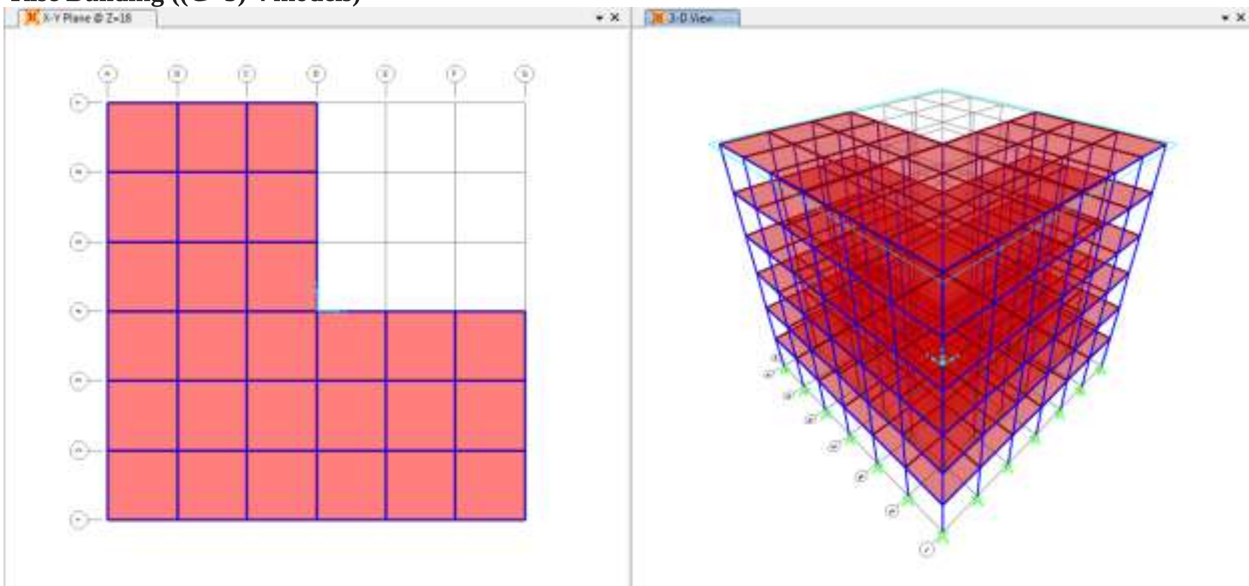
G+15 Design details	
Type of structure	RCC frame structure
Number of stories (G+5)	6 Stories
Story to story height	3m
Ground story height	3m
Building Height	3+3*15=48m
Grade of concrete	M30 for columns, Beams and slab
Thickness of slab	0.12m
Beam size	0.4mX0.4m
Column size	0.6mX0.6m
Density	For concrete 24kN/m^3

Types of loads acting on a structure are:

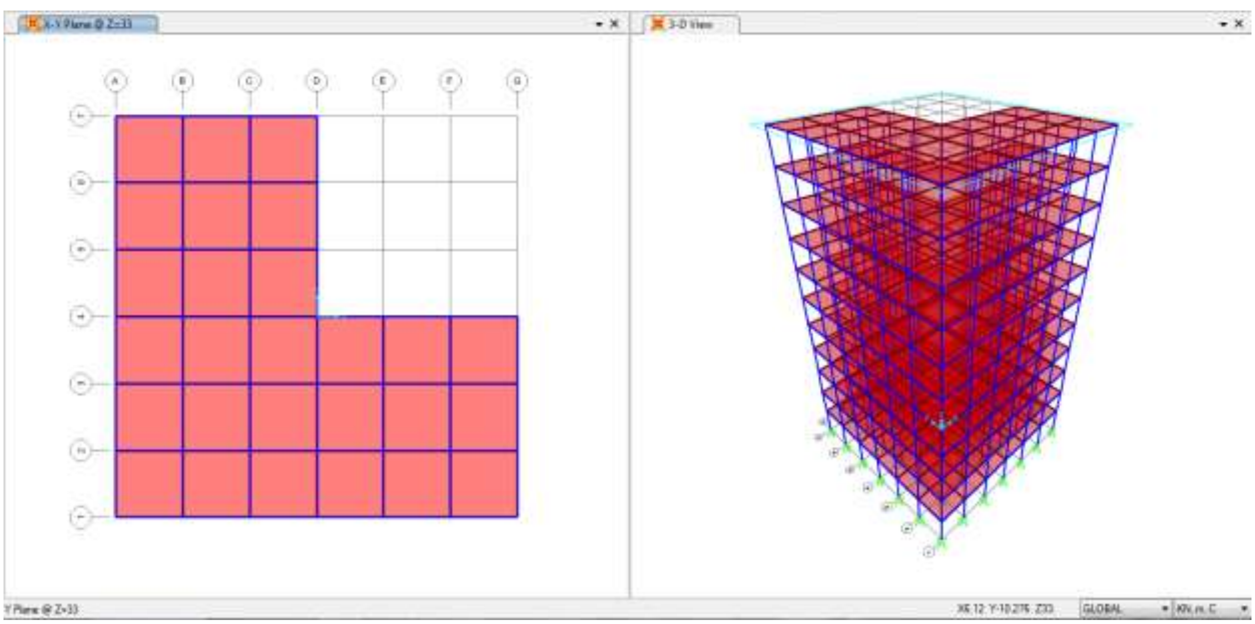
a. Dead loads
b. Live load
c. Floor finishing load
d. Wind loads
e. Seismic load

3.9 MODELS IN SAP 2000 V19

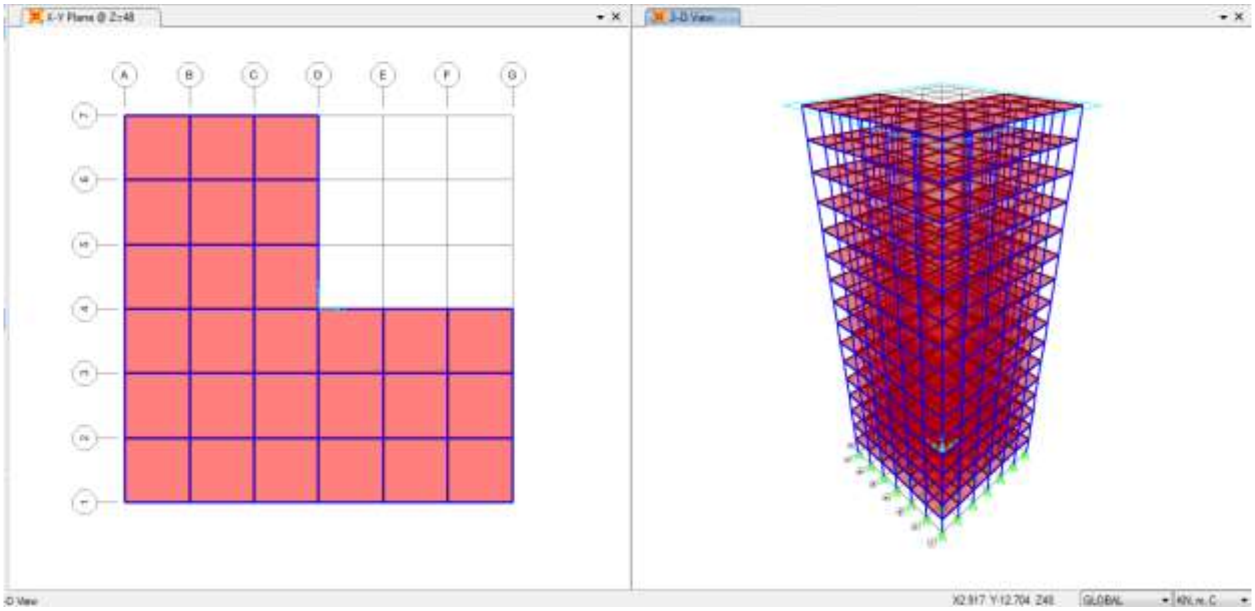
Low Rise Building ((G+5) 4 models)



Medium Rise Building ((G+10) 4 models)



High Rise Building ((G+15) 4 models)

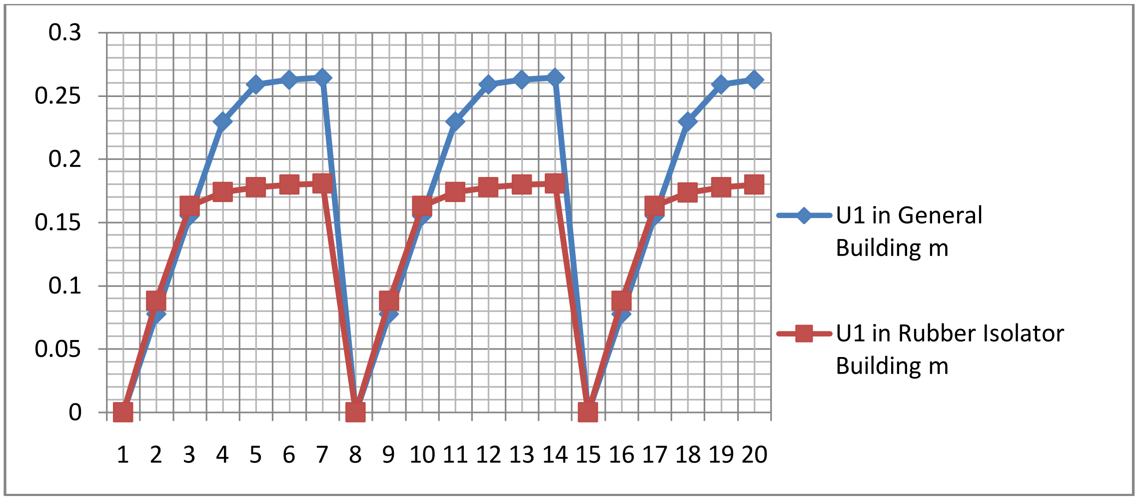


RESULTS

1. G+5 (Low Rise Buildings)

A. Joint Displacements (U1)

Joint Text	U1 in General Building m	U1 in Rubber Isolator Building m
1	0	0
2	0.077668	0.088201
3	0.155267	0.163124
4	0.229849	0.173838
5	0.259191	0.177855
6	0.262826	0.179746
7	0.26441	0.180677
8	0	0
9	0.077661	0.088141
10	0.155255	0.16306
11	0.22984	0.173792
12	0.259207	0.177837
13	0.262875	0.179754
14	0.264485	0.180697
15	0	0
16	0.077651	0.088076
17	0.155241	0.162995
18	0.229828	0.173743
19	0.259219	0.177822
20	0.262926	0.179762



CONCLUSIONS

From the above study the following conclusions were made

1. For the Low rise buildings, Medium rise Buildings, the values of joint displacements is less for the Rubber isolator buildings in U1 direction. Whereas in case of High rise buildings the value is less for U1, U2 and U3 directions.
2. The values of support reactions are less for all the buildings (Low, Medium, and High Rise Buildings) for forces.
3. The value of support reactions for moments are only exists for the General Buildings and it has negligible value for the Rubber isolator Buildings.
4. The values of lateral load P is maximum in General Buildings for Low rise Buildings. For the medium rise and High rise buildings the values of lateral load is less for Rubber isolator Building.
5. In all the cases the value of shear force is less for the Rubber isolator Building and is negligible.
6. In all the cases the values of Bending moment has less value for the Rubber Isolator Buildings.
7. The building Torque has Zero values for the Rubber isolator Buildings.

From the above conclusions the Rubber Isolator Buildings has less values of Displacements, SF, BM, Torque against Earth quick loads.

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