Seismic Analysis of Unsymmetrical Structure By Base Isolation

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Abstract- *Recently Base Isolation Technique has been used to mitigate the effect of seismic waves. It can be adopted for new structures as well as the retrofit of existing structures, Isolators decouple the superstructure from its foundation as it partially absorbs and partially reflects the input seismic energy before it transmitted to the super structure. it is a comparative study of fix base RC frame structures and isolated base RC frame structures with different plan geometries this include Lead Rubber Bearing isolator. A Time history Analysis is carried out for El-centro earthquake for G+6 storey building modeling and analysis is done using E-tabs software. Results obtain from analysis shows how an isolation system can be efficient, evaluating its effectiveness for the building in terms of maximum shear force, maximum bending moment, base shear, Joint displacement.*

Keywords- Base isolation, lead-rubber bearing, time-history analysis.

I. INTRODUCTION

Base isolation technique was started in 1923 by scientists and engineers and therefore various techniques of isolating the buildings and structures from earthquake forces are developed. The concept of base isolation represents a radical departure from the current seismic design practice. The building is isolated from the ground in such a way that only a very small portion of seismic ground motion is transmitted up through the building. There are two basic technologies used to protect buildings from damaging earthquake effects these are base isolation devices and seismic dampers. The ideas behind Seismic dampers and special devices introduced in the building to absorb the energy provided by the ground motion to the building (much like the way shock absorbers in motor vehicles absorb the impacts due to undulations of the road) base isolation is one of the most popular means of protecting a structure against earthquake forces. It is one of most powerful tools of earthquake engineering pertaining to the passive structural vibration control technologies. It is easiest to see the principle at work by referring directly to the most widely used of these advanced techniques, known as base isolation. A base isolated structure is supported by a series of bearing pads, which are placed between the buildings and building foundation. The concept of base isolation is explained through an example of building resting on frictionless rollers. When the ground shakes, the rollers freely roll, but the building above does not move. Thus, no force is transferred to the building due to the shaking of the ground; simply, the building does not experience the earthquake.

II. METHODOLOGY

In this study moment resisting RC frame buildings of Rectangular-shape structure and C-shape, L- shape, T-shape G+7 unsymmetrical structures are considered. This structure is designed and analyzed by using E-tabs software. Dynamic characters of base isolated buildings are investigated by using Lead rubber bearing. The structure provided with irregular plan geometry has similar specifications as per Regular Ideal structure the structures are analyzed by same software. For comparison of result of both regular structure and irregular shapes details are given below the analysis of the structure, maximum shear forces, bending moments, storey displacements are computed and compared for all cases.

III. MODELLING IN ETABS

The mathematical model of G+7 storey building isCreated in ETABS with following details given in table 1, table 2 and table 3. The table-1 shows the building description including structural details, material details table-2 shows loadings, seismic load conditions and table-3 shows Lead rubber bearing summery obtain after calculation.

TABLE 1. Building description

Number of storey	G+7
Height of building	3m
Dimension of building	20Mx16m
Grade of concrete	M30
Type of isolator	Lead rubber bearing
Size of column	300X500
Size of beam	300X450
Support conditions	Fixed, Spring
Width of slab	125mm

TABLE 2. Loading conditions

Shell Loads	
Live Load	4KN/m^2
Dead Load	6.25KN/m^2
Seismic load condition	
Zone	IV
Zone Factor	0.24
Importance factor	1.5
Response reduction factor	3

TABLE 2. Lead rubber bearing summery

LRB Parameter	Rectangu-lar shape	C-shape	L-shape	T-shape
Required Stiffness(Keff)	52498	39501	41518	41518
Horizontal Stiffness (Kb)	11097.92	8219	8367	8367
Vertical Stiffness (Kv)	232.56	10267	10238	10238
Yield Force	249.35	187.61	197.17	197.1
Damping co-eff	2683426.2	64733.3	68100	68100
Stiffness Ratio	0.1	0.1	0.1	0.1

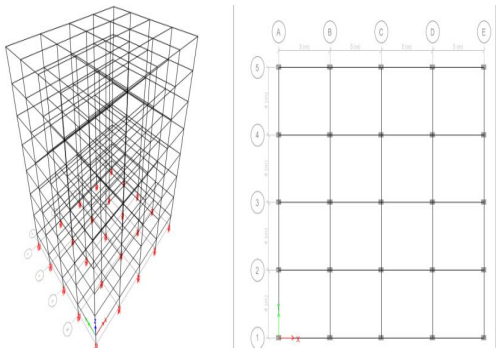

Fig-1. Isolated base Rectangular structure

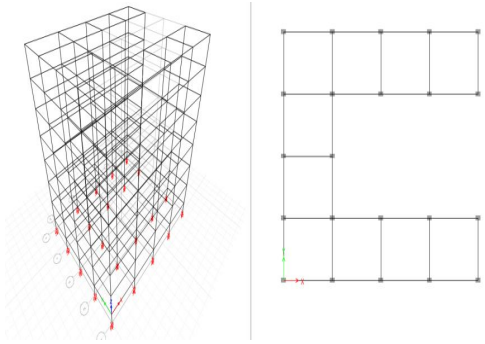

Fig-2. Isolated base C- shape structure

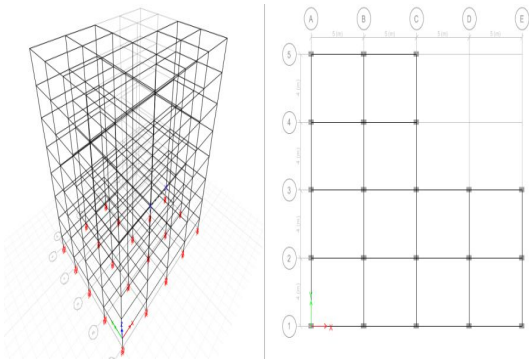

Fig-3. Isolated base L- shape structure

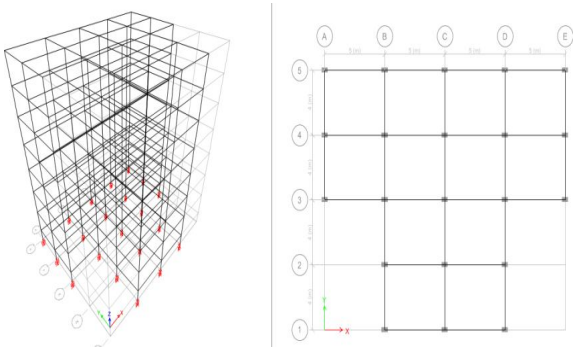

Fig-4. Isolated base T- shape structure

IV. RESULT AND DISCUSSION

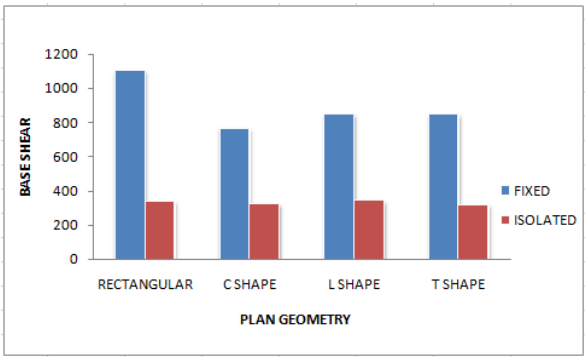

Fig 5. Comparison of base shear

Fig. 5 shows the graphical representation of base shear in X-direction for different plan geometries. It indicates that base shear is maximum for rectangular fixed base structure. In case of isolated structures base shear reduces as compare to fixed base structure.

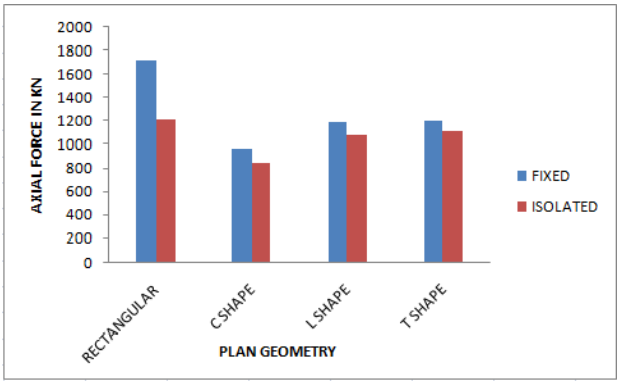

Fig 6. Comparison of axial forces in column

Fig.6 It is observed that, the axial force is only link with the dead load of structure so the axial force is more in case of fixed base rectangular structure axial force is gradually decreases after providing Lead rubber bearing isolator.

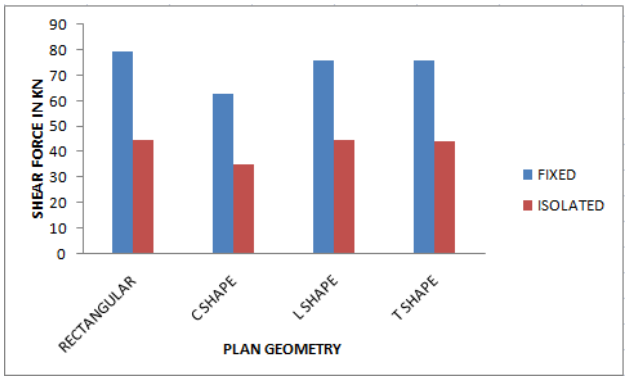

Fig 7. Comparison of shear force

Fig 7. Comparison of shear force in column

Fig.8 Graph shows the comparison of shear force induced in column along second local axis. As per graph shear force induce in L, T shape fix base structure is nearly same and in T shape isolated base structure shear force is minimum than other plan geometries.

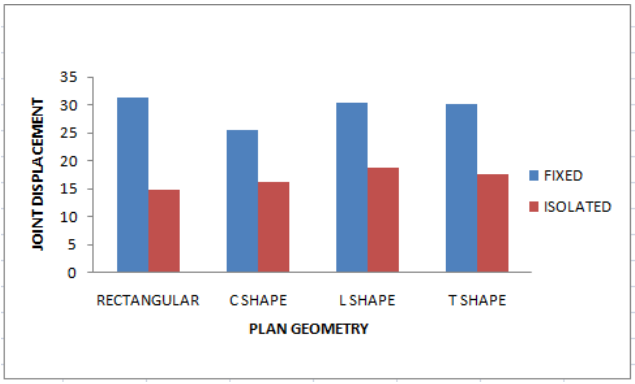

Fig 8. Joint Displacement in X-direction

Fig 8. Indicate that comparison of displacement in X-direction from the above results it is observed that displacement is maximum for rectangular fixed base structure and minimum for isolated C-shape structure.

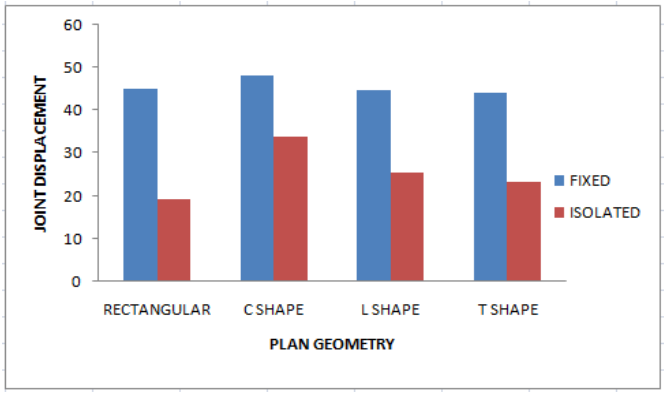

Fig 9. Joint Displacement in Y-direction.

Fig 9. It is observed that the displacement in the transverse direction i.e in Y-direction shows more displacement in Fixed base structures as lead rubber bearing is provided displacement reduces for all plan geometries.

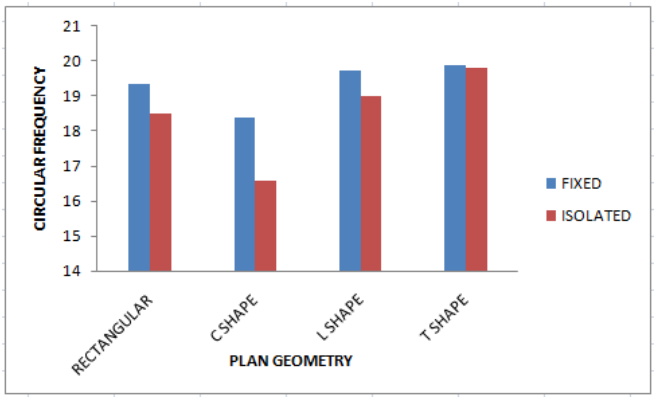

Fig 10. Comparison of circular frequency

Fig 10. It is observed that there is marginal difference in circular frequency of fixed base and isolated base

T shape structure. And lowest frequency is observed for isolated base C-shape structure.

V. CONCLUSION

- According to the research work we have come to the conclusion that
- Above study shows that, the base isolation concept has convincing advantages in comparison to conventional construction techniques.
- Base shear is maximum for rectangular shape geometry in x, y and vertical direction; in case of isolated base it reduces by approximately 75%.
- In case of column forces maximum axial force induced in rectangular shape and it reduces by approximately 25% after providing isolation.
- Shear force in beam forces is greater in L-shape fix base structure and when isolator is provided it reduces by 60%.
- Joint displacement of rectangular shape isolated base in X and Y direction is approximately 40-46% less than rectangular shape fix base.
- In vertical direction joint displacement is maximum for rectangular shape isolated base and minimum for L shape isolated base.
- C shape isolated base structure circular frequency is less as compare to other plan geometry.

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