Parametric study of T, L, Plus and C shape multi storey building with base isolators

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Abstract: Earthquake resistant innovation has been a major problem. The most common approach is to make the structure more complex, but the concept of basic insulation technology has been around for decades. According to research on the nature of earthquakes shows that asymmetric buildings are more likely to collapse in an earthquake. In this study, different basic insulation methods were used to study the vibration responses of the most common buildings in the plan, and the scope analysis of the building models response was performed with ETABS 2017. This essay reads the various parameters, such as shear strength, playground acceleration, and relocation and building period. The foundation laid by the insulating base (friction pendulum and insulation leading to ball bearings). The study also compared the performance of three unusual L-shaped, T-shaped and Plus shaped buildings with a single area. 9 Multi-storey building models selected which contain G+10 number of storey and total number columns are 48 and beams are 80. Use M-30 concrete and Fe-415 grade steel. In proposed work an arched shape of beam will use and for analysis we use software ETAB 2017 and analyze the different model on changing shape with re-entrant corners and isolators.

Key point: Base Shear force, Storey deflection, Storey drift, friction pendulum and lead rubber bear isolator, ETAB-2017.

Introduction

Earthquakes are one of the main natural hazards that cause enormous damage to buildings and property. The earthquake, in a sense doesn't kill people but buildings do. Thus the buildings need to be seismic resistant for providing safety to life and property. Base isolators are installed between the superstructure and the foundation thus the amount of vibration transferred to the superstructure can be considerably reduced. It is because they imparts flexibility in the horizontal direction and thus deflects it through the dynamics of the system. So the concept of base isolation has been widely in use since a few decades.

The inferences from the studies carried out on the performance of buildings during earthquake showed that irregular buildings were more vulnerable to collapse than symmetric buildings. But in the present scenario, the constructions of irregular buildings have become inevitable. Therefore, the present study is conducted to understand the structural behavior of plan irregular base isolated buildings in comparison to fixed base irregular building under seismic loading. It is recommended that for analysis of plan irregular buildings dynamic analysis needs to be carried out and hence response spectrum method of analysis was done utilizing software ETABS.

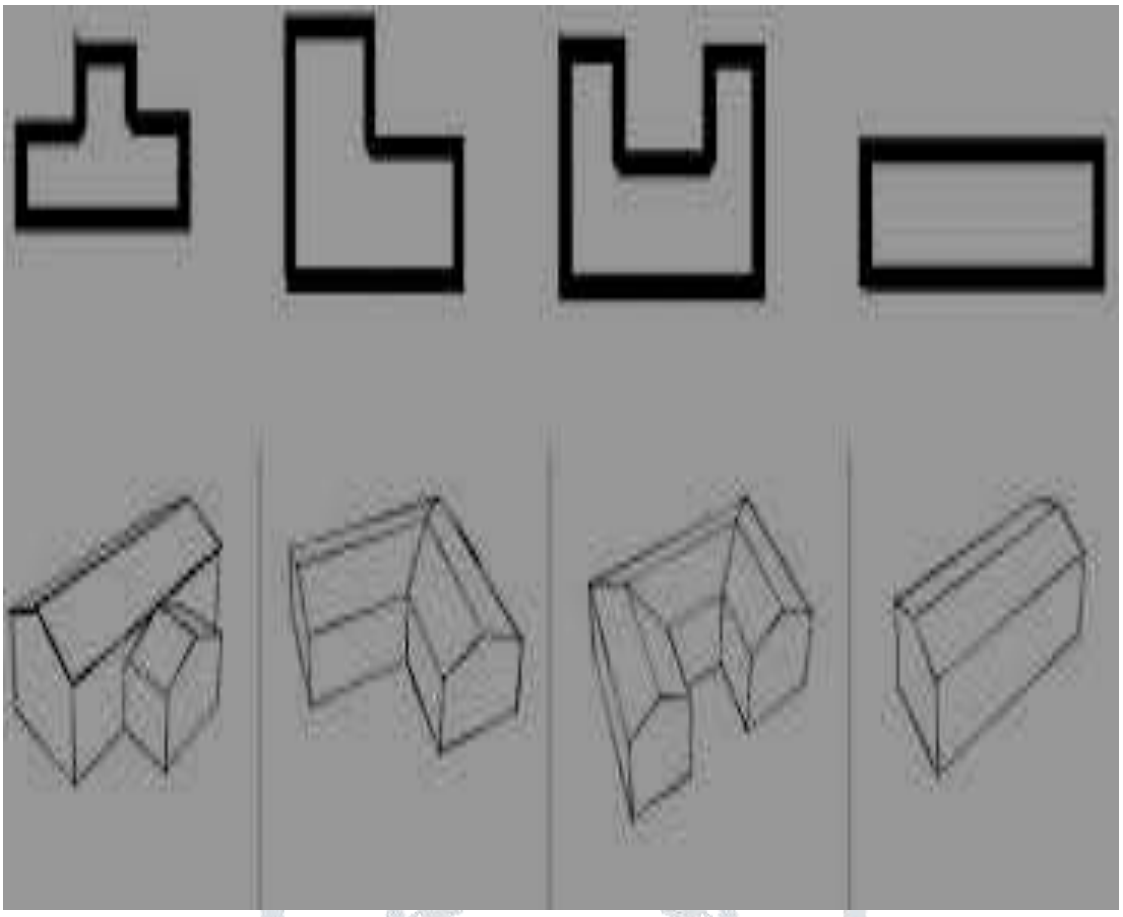

Fig.1 different shape of buildings

Objectives of the Study

1. To analysis of bending moment, shear force for an arched beam.
2. Find best shape of building plan for which minimum axial force and deflection is finding for dead load and seismic load and combination of it.
3. Draw a graph between different configurations for bending moment and various parameters such as total base shear force, storey acceleration, displacement and time period of a building with respect to the fixed base and isolated base (friction pendulum and lead rubber bearing isolator).
4. Suggest shape of best building**.**
5. To study the seismic response of T, L, PLUS and C shape plan irregular buildings under FPS and LRB base isolation techniques by carrying out a response spectrum method of analysis on the building models using ETABS v2016.

- ✓ The following parameters are under study.
- ✓ Storey deflection
- ✓ Storey drift
- ✓ Different shapes like T, L, PLUS and C shape with different isolators like FPS, LRB and Ccompare to performance of building in plan with same area.
- ✓ Base Shear force

Critical Remarks from literature Review

- It has been found that fundamental time period of base-isolated building is increased by 28% compared to conventional building.
- Also, base shear value of the base-isolated structure is reduced by 69% and top storey acceleration is decreased by 75% compared to conventional building.
- The center of mass and center of rigidity is influenced by adding and positioning of shear wall
- Storey displacement and storey shear of asymmetric structures subjected to earthquake loadings are more compared to symmetric structures.
- The buildings with severe irregularity are more vulnerable than those with regular configuration resulting from torsion behavior, and the additional shear force produced in the perpendicular direction to the earthquake input.
- the base shear is reduced in base isolated structures, thus the response of building is good in base isolated structures than fixed base structures
- After providing base isolator the mode period of structure is increased by 19% and 47% for G+13 and G+5 storey buildings.

Research Gap

From Literature review, it is found that researches have been done in following area.

- Analysis of RC frame structure regular and irregular building.
- Effect of Base Isolation in Multistoried RC Regular building.

It is found that less work has been done on

- Comparative study of the T, L, PLUS and C shaped building with FPS and LRB isolators and fixed base
- Dynamic earthquake analysis of T, L, PLUS and C shaped buildings.

Scope of Work

- Study the software ETABS v2016.
- Prepare 3D model of RC frame structure having L shape, T shape, PLUS shape and C Shape performing validation procedure.
- Prepare the model for study.
- Analyze the different model on changing shape with base isolators
- Model I: Plus- shaped Building with Fixed Base
- Model II: Plus- shaped Building with FPS isolator
- Model III: Plus- shaped Building with LRB isolator
- Model IV: T- shaped Building with Fixed Base
- Model V: T- shaped Building with FPS isolator
- Model VI: T- shaped Building with LRB isolator
- Model VII: L- shaped Building with Fixed Base
- Model VIII: L- shaped Building with FPS isolator
- Model IX: L- shaped Building with LRB isolator
- Model X: C- shaped Building with Fixed Base
- Model XI: C- shaped Building with FPS isolator
- Model XII: C- shaped Building with LRB isolator

Methodology

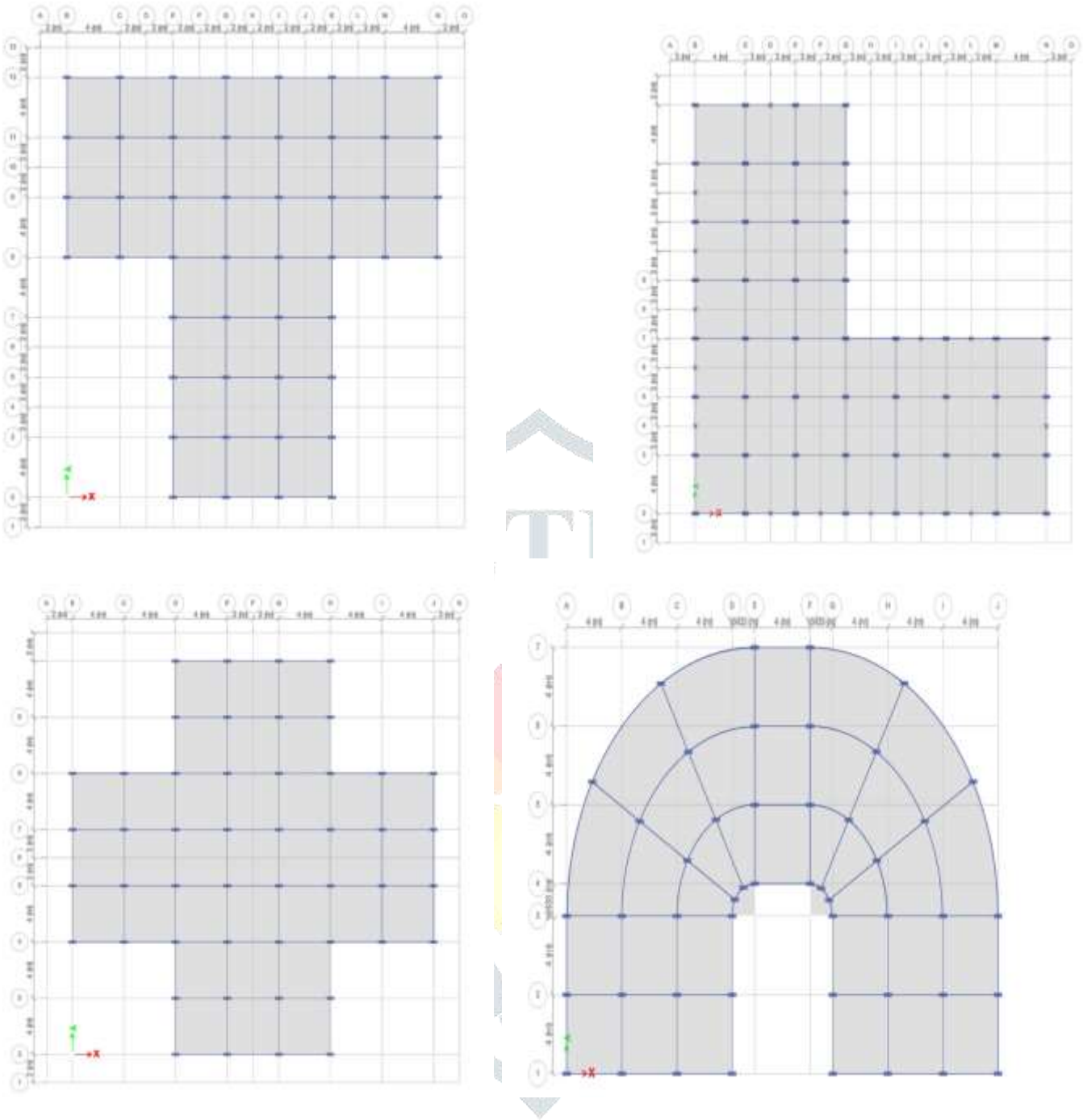

Fig.2 different type of models used in study

Validation: model details

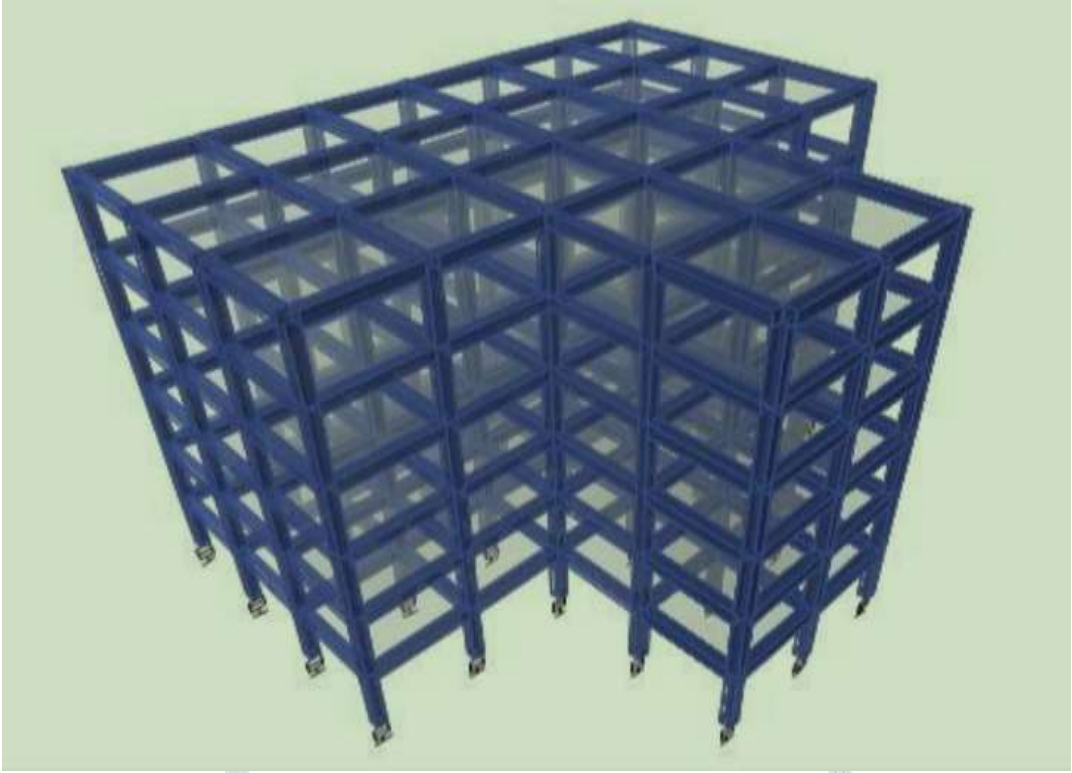

Fig.3 Seismic elastic performance of building frames through plan irregularities (Journal: - Structures

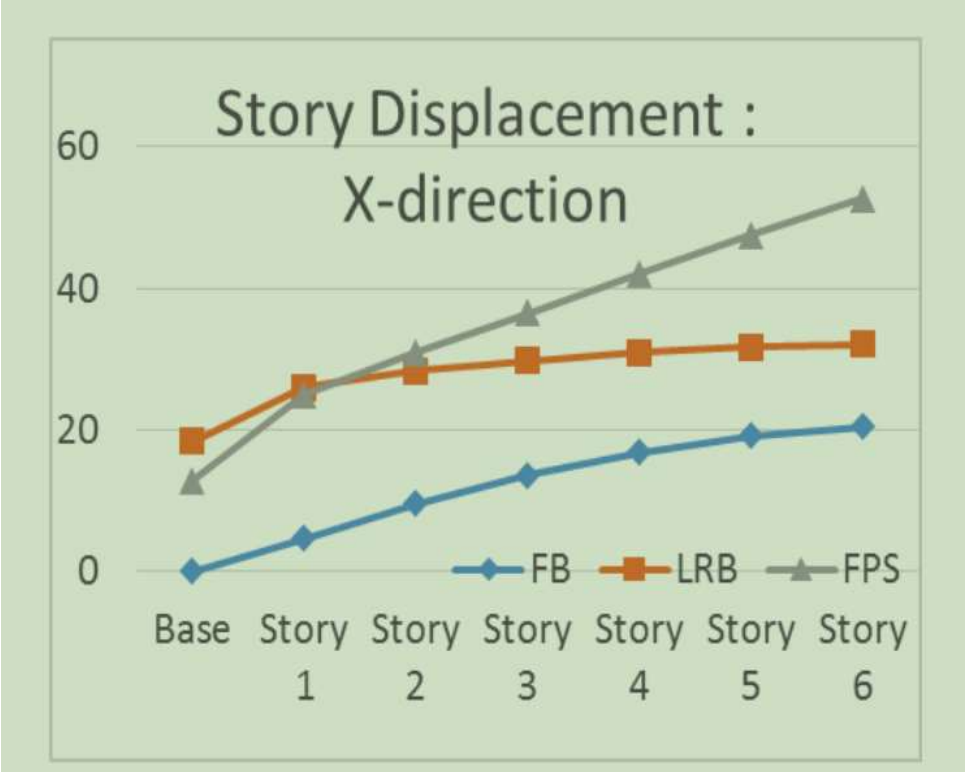

Fig.4 reference paper graph

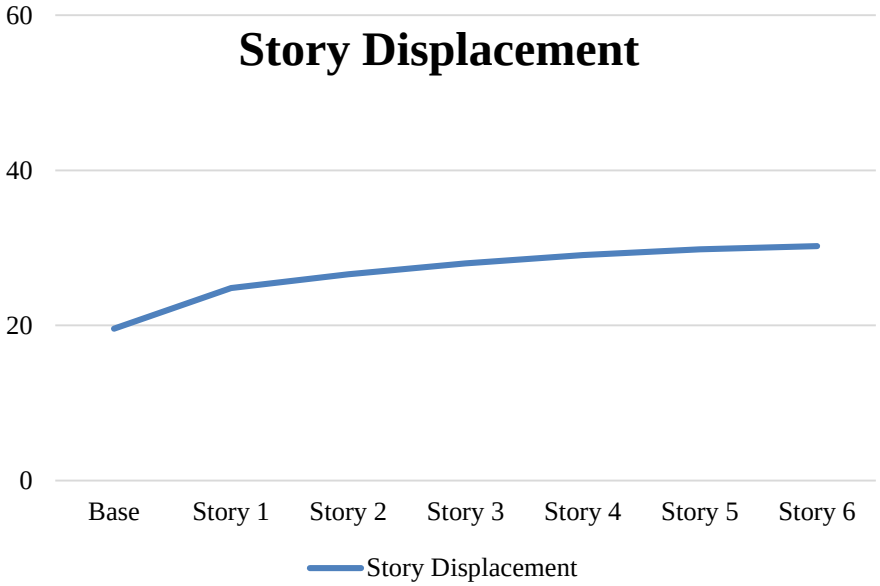

Fig.5 validation graph

Table 1 displacement validation

Story	Displacement		Variation
	My validation result	Base paper result	
Base	19.576	19.00	2.98%
1	24.808	23.70	4.56%
2	26.614	25.70	3.49%
3	27.990	26.80	4.34%
4	29.060	28.50	1.94%
5	29.811	29.00	2.75%
6	30.238	30.00	0.76%

Displacement Result

Table 2 displacement result

SHAPE	FPS	LRB	FIXED BASE
T	17.0156	18.9875	247.981
C	17.8333	19.0790	263.794
L	16.7467	18.9043	250.466
PLUS	16.1533	18.8334	234.272

Drift Result

SHAPE	FPS	LRB	FIXED BASE
T	0.030547	0.000298	0.011339
C	0.000379	0.000647	0.012139
L	0.00015	0.0003	0.012107
PLUS	0.000146	0.01446	0.011204

Conclusion

- Building with FPS isolator performs better than LRB and Fixed Base When Subjected to earthquake loading.
- LRB and FPS show similar results under earthquake loading.
- FPS is more efficient to reduce the storey displacement and storey drift under earthquake loading.
- Fixed base building of all the types show similar trends in storey displacement there is not much difference.
- C shape building with curved beams shows maximum displacement under earthquake loading.

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