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Comparative Study of Static and Dynamic Seismic Analysis of Multi-Storeyed RCC Building by Using E-tabs for Different Plan Configurations

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***Abstract*: E-tabs are powerful tool for analysing and design of low and high rise building systems. The behaviour of multi- storied RCC building of regular and complex configuration under earthquake is difficult. In this project seismic analysis is carried out with different plan configurations like rectangular, L, I, C and T –shaped multi-storeyed RCC structure. Analysis is done under static and dynamic loading condition. In this paper compare storey displacement, storey drift, shear and overturning moment for all the case.**

***Keywords*: RCC Buildings, Static Analysis, Response Spectrum Method.**

1. Introduction

Earthquakes are the sudden movement of the ground. Sudden release of energy causes the seismic waves. The waves can cause large vibrations on the structure. Effective and quality design reduces the failure of structure during the earth quake. RCC structure with regular geometry, mass distribution, good lateral strength and stiffness produces less damage than irregular structure. RCC structure with plan irregularity produces more deformation than regular in high seismic zone area. E-tabs are the best tool in earthquake engineering which used to understand the response of building during earthquake. E-tabs offer different analysing methods.

- Linear static procedure
- Nonlinear static procedure
- Linear dynamic procedure
- Non-linear dynamic procedure
- Response spectrum method
- Time history method

The present study mainly deals with linear static procedure and Response spectrum method. In this comparison study adopt five different plan configurations. By this analysis of the RCC framed structure compare maximum storey displacement, maximum drift, overturning moments and shear.

2. Objective

- The target of this analysis is to find out the seismic response of multi-storied RCC building using E-tabs for regular and irregular plan configurations.
- To make the building earthquake resistant against seismic effect.
- To analysis and compare the variation of story drift, displacement, shear, and overturning moment with the variation of structure shapes.

3. Future Scope

The main scope of this thesis is to make earthquake resistant structure in seismic prone areas. This analysis study is carried out for check the allowable changes in the seismic design of regular and irregular shaped reinforced structure.

4. Methodology

- Literature survey by referring books
- Selection of type of structures
- Fixing of basic data for structure
- Modelling of the selected structures
- Analytical work is to be carried out
- Comparisons of analysis results
- Preparation of graphs
- Result and conclusion

5. Modelling of RCC frames

A. *Structural data*

Table 1
Structural data

1	Shape of structure	Rectangular, L, I, C , and T Shape
2	Length and width	30M x30M
3	No. of stores	10
4	Story height	3m
5	Beam dimension	450x450mm
6	Column dimensions	600x600mm
7	Slab thickness	15mm
8	Thickness of main wall	20mm
9	Support condition	Fixed
10	Grade of Concrete	M25
11	Grade of Steel	Fe500

B. *Loading parameters*

- Dead load
- Live load
- Seismic load
- Seismic zone: V (Z=0.36).
  - Soil type: II.
  - Importance factor: 1.
  - Response reduction factor: 5.
  - Damping: 5%.

C. *Load combination*

Table 2
Load combination

1	Combination1	1.5(Dl+LL)
2	Combination2	1.2(DL+LL)
3	Combination3	1.2(DL+LL±Ex)
4	Combination4	1.2(DL+LL±Ey)
5	Combination5	1.5(DL±Ex)
6	Combination6	1.5(DL±Ey)
7	Combination7	0.9Dl±1.5Ex
8	Combination8	0.9DL±1.5Ey
	Combination9	1.2(DL+LL±Ex)
9	Combination10	1.2(DL+LL±Ey)

6. Layout of Structure

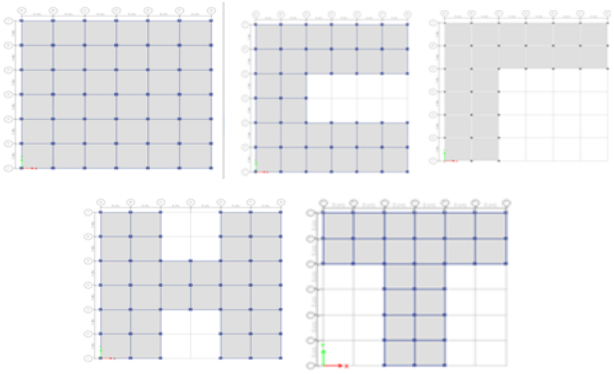
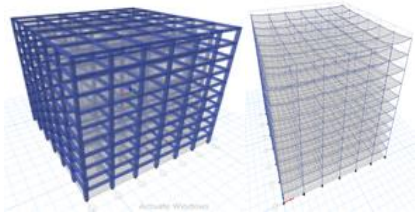
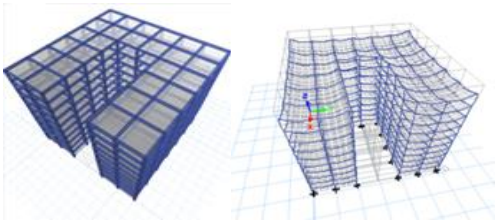


Fig. 1. Plan of structure (a) Rectangular (b) C-shape (c) L-shape (d) H-shape (e) T- Shape

7. Modelling of Structure in E-tabs



(a)



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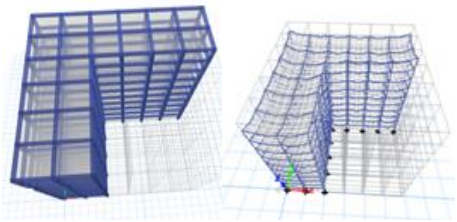
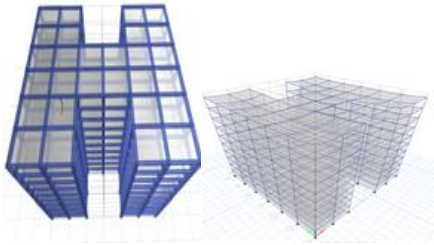
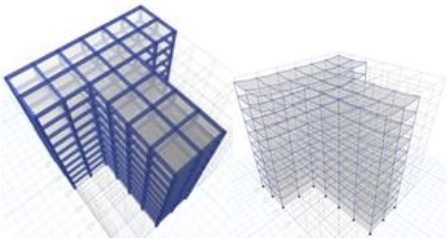


(c)



(d)



(e)

Fig. 2. 3-D view and deformed shape of structure (a) Rectangular (b) C-shape (c) L-shape (d) H- shape (e) T- Shape

8. Results and Discussion

A. *Storey Displacement*

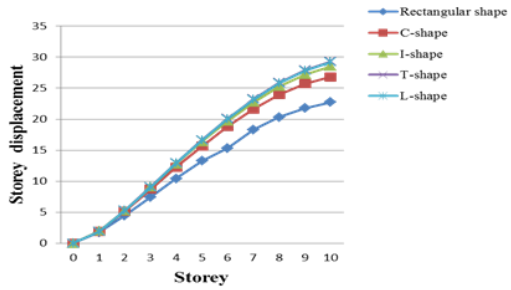


Fig. 3. Graph of displacement for different shape of the buildings Under static load

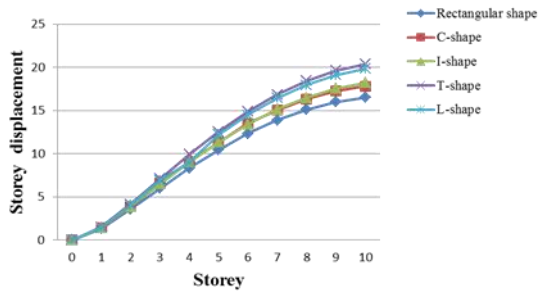


Fig. 4. Graph of displacement for different shape of the buildings Under dynamic load

- Above graph shows that the maximum storey displacement for different shape of structure.
- From the graph it is noted that displacement increases from lower storey to last one.
- Displacement for rectangular shape of the building is less than irregular shaped structures like C, I, T and L shaped structure.
- Displacement values obtained from static analysis gives higher values than dynamic analysis

B. *Storey shear*

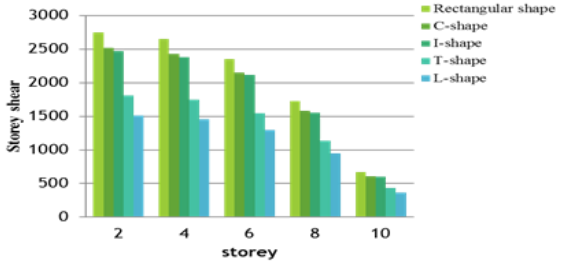


Fig. 5. Graph of storey shear for different shape of the buildings Under static load

The fig. 6 shows the, Comparison of Base Shear for different storey for different shape of the Buildings. Graph shows the comparison of 2ed, 4th, 6th, 8th, 10th storey shear. Values of shear decrease with the increase in height of storey.

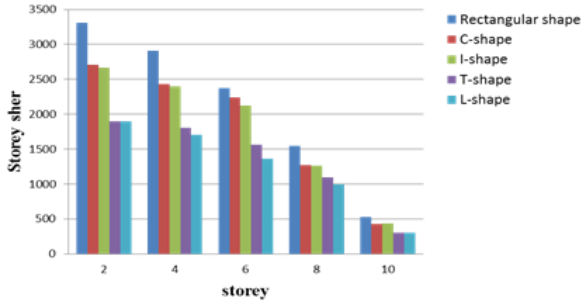


Fig. 6. Graph of storey shear for different shape of the buildings Under dynamic load

C. *Storey drift*

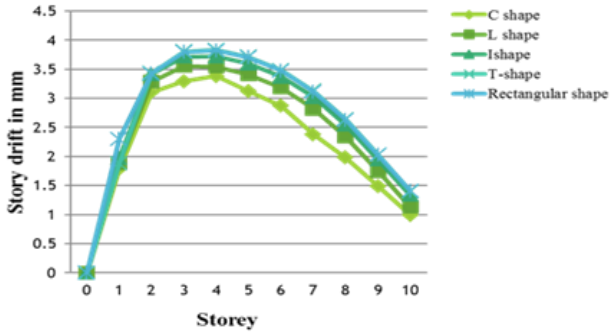


Fig. 7. Graph of storey drift for different shape of the buildings under static load

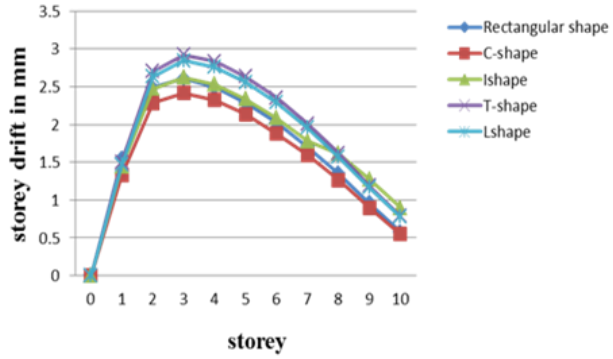


Fig. 8. Graph of storey drift for different shape of the buildings under dynamic load

D. *Overturning moment*

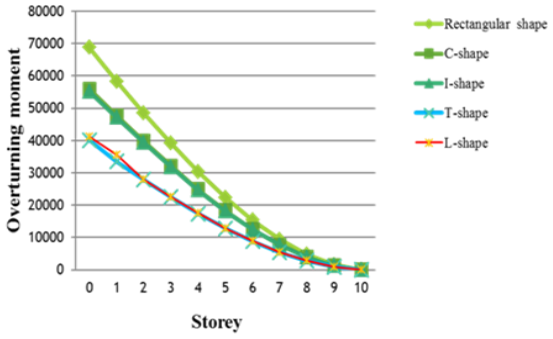


Fig. 9. Graph of storey drift for different shape of the buildings under static load

- Comparison of regular and irregular configuration the story drift value is more in the rectangular shaped configuration.
- Maximum storey drift permitted = 0.004x height of storey.
- Height of storey=3000mm
- Maximum storey drift 0.004 X 3000=12mm (for all storey.

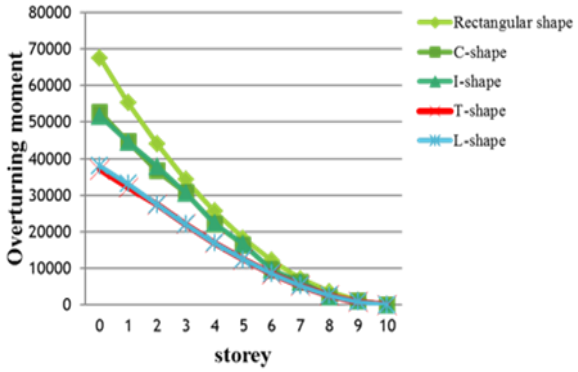


Fig. 10. Graph of storey drift for different shape of the buildings under dynamic load

- Rectangular shaped building produce higher overturning moment than other shapes of the building.

9. Conclusion

- Regular and Irregular shapes of RCC structure are analysed by using E-tabs under static and dynamic load. From the comparison irregular shaped structures are heavily affected during earthquakes.
- Displacement values obtained from static analysis gives higher values than dynamic analysis that is why Static analysis is not sufficient for high rise buildings.
- Drift value is more in the rectangular configuration.
- Shear value occur more in the lower stories. Compare to C, T, and L and, I –Shaped irregular models gives smaller shear values than rectangular model.
- Storey overturning moment varies inversely with storey height.

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