International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 06 | June-2018 www.irjet.net p-ISSN: 2395-0072

THE DYNAMIC ANALYSIS OF L AND H SHAPE OF G+15 STOREY BUILDING

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Abstract: *This paper consists of evaluate the capacity and performance of reinforced concrete L and H shape of multi storey building structures under seismic loading (response spectrum) analysis has been performed to study the influence of shape of a building on its response to various loading especially those structures which are having an uneven distribution of structural stiffness in both plan and elevation. Main objectives of this project are to perform dynamic analysis. The most important objective of this study is to grasp the behaviour of the structure in high seismic zone and also to evaluate Storey overturning moment .For this purpose, L and H shape of multi storey building structures are initially analyzed and designed which is having critical member in the structure under critical load combination using IS 456:2000. The post processing values of maximum deflection, bending moment and shear forces are to be obtained for high seismic zone and compare with the even distribution of structural stiffness in both plan and elevation, using ETABS V9.7- finite element software, under the combination of gravity and seismic loading.*

Key Words: *ETABS V9.7, IS CODE, L & H Shape structure, seismic load*

1. INTRODUCTION

Our project involves performing dynamic analysis of L and H-shaped multy-story building by using ETABS software.

We have chosen ETABS because of its following advantages:

- Easy to use interface.
- Relevance with the Indian Standard Codes.
- Adaptable nature of solving any type of problem.
- Accuracy of the solution.

ETABS features a state-of-the-art user interface, visualization tools, and powerful design and analysis capabilities. From model creation, analysis and design to visualization and result verification, ETABS is the professional's choice for steel, concrete, timber, aluminum and cold-formed steel design of low and high-rise buildings, culverts, petrochemical plants, tunnels, bridges, piles and much more.

2. OBJECTIVES OF THE STUDY

- Main objectives of this project are to perform dynamic analysis.
- To obtain Seismic performances of different shape of structures located in severe Earthquake zone (V) of India.
- The most important objective of this study is to grasp the behaviour of the structure in high seismic zone and also to evaluate Storey overturning moment
- Dynamic (response spectrum) analysis has been performed to study the influence of shape of a building on its response to various loading
- To analyze the 15 story R C framed building structure.
- To analyze critical member of the structure under critical load combinations.

3. PROBLEM STATEMENT

Building details:

The structure is 40m in x-direction & 32m in y-direction with columns spaced at 4m from centre to centre. The storey height is kept as 3m. Basically model consists of multiple bay fifteen storeys building, each bay having width of 4m. The storey height between two floors is 3.0m with beam and also the slab and shear wall thickness is taken as 0.15m.

A. The material properties and geometry of the model are described below

1) Length X width: 40m X 32m
2) Number of stories: 15
3) Support conditions: Fixed
4) Storey height: 3 m
5) Grade of concrete: M30
6) Grade of steel: Fe500
7) Size of columns from 1-15 storeys: 700mm x 500mm
8) Size of beams: 230mm x 500mm
9) Thickness of main wall: 230mm

4. MATERIAL AND LOADING PARAMETERS

IS 456:2000 is followed.

- Grade of Concrete M23 implies f_{ck} =30 N/mm^2.
- Type of steel used – f_y =500N/mm^2.
- Cover provided = 45mm for beams and columns.

Members are loaded with dead load(DL) and live load(LL) and wall load (WL), earthquake load(EQ) in both X and Y directions as per IS 1893 (Part 1) 2002, load combinations are applied.

Live Load = 2 kN/m^2.
Floor finish = 2.5 kN/m^2

5. PROBLEM FORMULATION

The structures are acted upon by different loads such as dead load (DL), Live load and Earthquake load (EQ).

A. Self-weight of the structure comprises of the weight of the beams, columns and slab of the structure.

B. Dead load of the structure consists of Wall load, and floor load, according to (IS875 (Part1)).

1) Wall load: weight unit of brick masonry X thickness of wall X height of the wall = 20 KN/m3 X 0.230m X 3m=13.8 KN/m.

C. Live load: It consist Roof load as 2 KN/m2, according to (IS 875(Part 2).

D. Seismic Load: The different seismic parameters are taken as follows, IS 1893(Part-1):2002.

- Seismic zone: V (Z=0.36).
- Soil type: II.
- Importance factor: 1.
- Response reduction factor: 5.0

7. DIFFERENT LOAD COMBINATION

Table 1: Various load combination

Load Combinations	Code Of Practice
1.7 (DL+LL)	As per IS:1893-2002 (for Earthquake)
1.7(DL+EQ_X)	
1.7(DL+EQ_Y)	
1.7(DL-EQ_X)	
1.7(DL-EQ_Y)	
1.3(DL+LL+EQ_X)	
1.3(DL+LL+EQ_Y)	
1.3(DL+LL-EQ_X)	

6. MODEL OF L AND H SHAPE MULTI STORY BUILDING IN ETABS

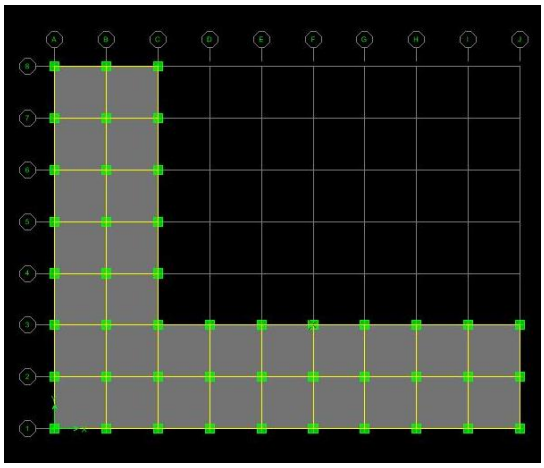

Fig -1: L Shape Plan

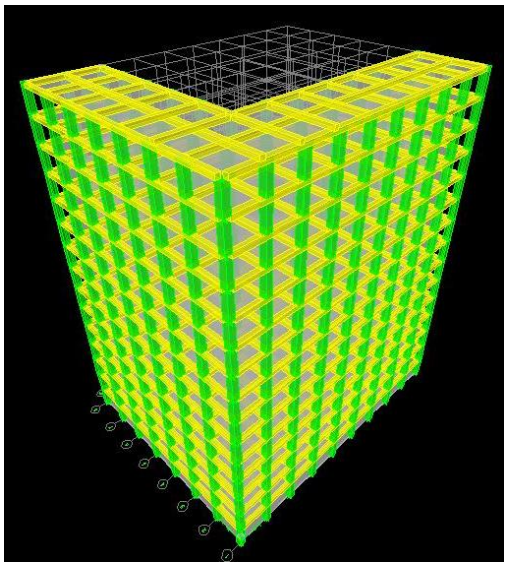

Fig- 2: L Shape 3D rendering view

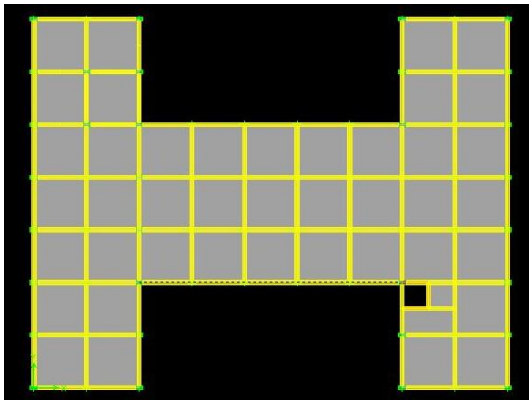

Fig- 3: H Shape Plan

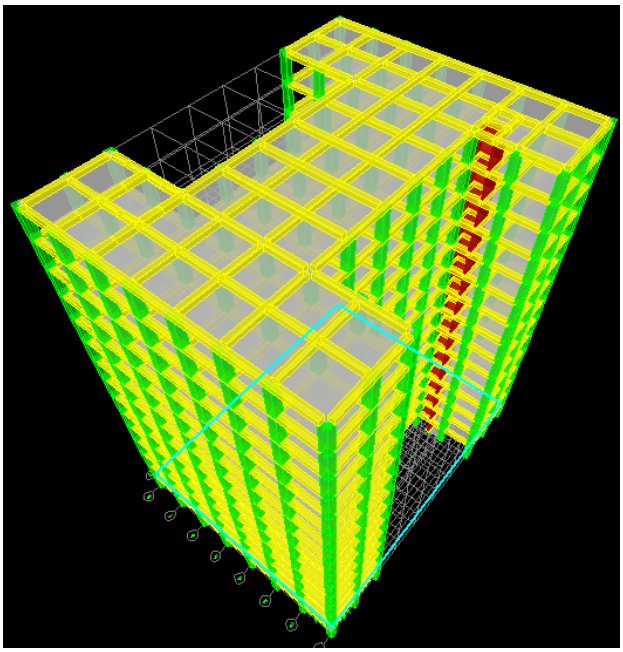

Fig-4: H Shape 3D rendering view

6. **METHODOLOGY:**

1. Creating the model by using grid lines
2. Defining material properties
3. Defining frame sections
4. Defining wall and slab sections
5. Defining diaphragms
6. Defining loads and Load Combinations
7. Analyzing.
8. Designing

7. RESULTS AND DISCUSSION

- **L SHAPE OF BUILDING STRUCTURE**

Maximum Bending Moment

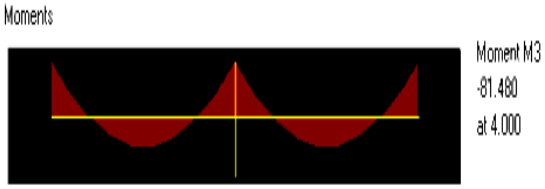

Fig -5: Maximum Bending moment Diagram-B14

Table 2.0: Positive and Negative Maximum Bending Moment

STOREY	BEAM	LOAD COMBINATION	M3 kN-m	M3 kN-m
12	B14	1.2(DL+LL+WL-EQY)	-81.48	34.615

The above table shows that Maximum Positive and negative BM at Story12 Beam No.14 of Load Combination 1.2 (DL+LL+WL-EQY).

Maximum Shear Force

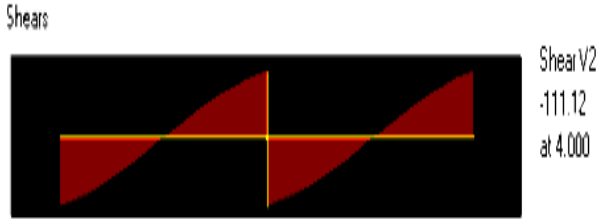

Fig -6: Maximum Shear Force Diagram-B14

Table 3.0: Maxi mum Shear Force

STOREY	BEAM	LOAD COMBINATION	V2 kN
12	B14	1.2(DL+LL+WL-EQY)	-111.12

Maximum Deflection

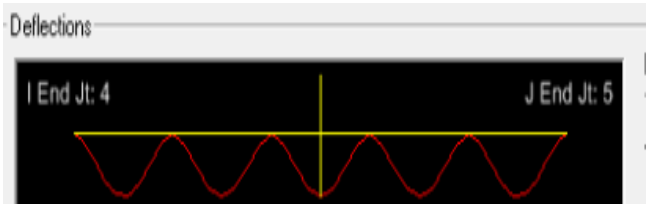

Fig -7: Maximum Deflection Diagram-B14

Table 4.0: Maximum Deflection

STOREY	BEAM	LOAD COMBINATION	Max. Deflection
12	B14	1.2(DL+LL+WL-EQY)	12mm

- **H SHAPE OF BUILDING STRUCTURE**

Maximum Bending Moment

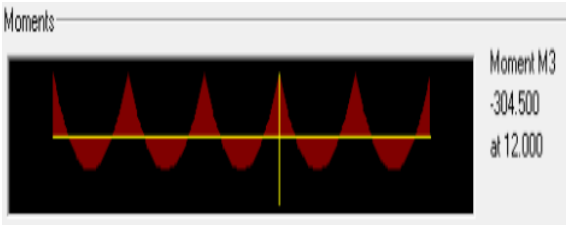

Fig -8: Maximum Bending moment Diagram-B10

Table 5.0: Positive and Negative Maximum Bending Moment

STORY	BEAM	LOAD COMBINATION	M3 kN-m	M3 kN-m
10	B10	1.2(DL+LL+WL-EQY)	-304.50	304.50

The above table is shows that Maximum BM at Story10 Beam10 of Load Combination 1.2 (DL+LL+WL-EQY).

Maximum Shear Force

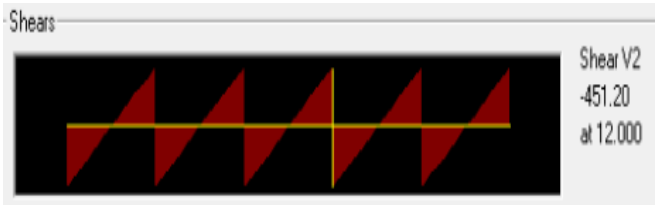

Fig -9: Maximum Shear force Diagram-B10

Table 6.0: Maximum Shear force

STOREY	BEAM	LOAD COMBINATION	V2 kN
10	B14	1.2(DL+LL+WL-EQY)	-451.20

Maximum Deflection

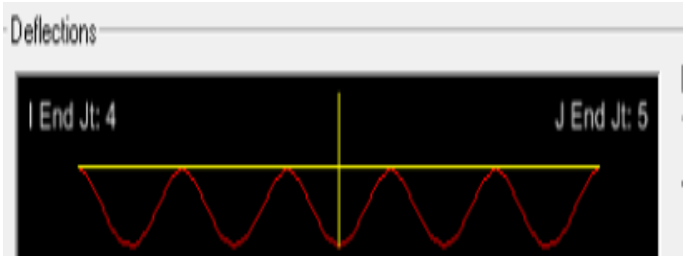

Fig -10: Maximum Deflection Diagram-B10

Table 7.0: Maximum Deflection

STOREY	BEAM	LOAD COMBINATION	Max. Deflection
10	B14	1.2(DL+LL+WL-EQY)	16mm

9. CONCLUSION

- H- Shaped and L- shaped multi-storey buildings are more susceptible to dynamic seismic load.
- H- Shaped and L- shaped multi-storey buildings are severely affected during earthquakes especially in high seismic zones.
- Results have been proved that H shape building is more vulnerable compare to L shape building.
- H shape building gets more deformation as compare to L shape building.

10. SCOPE OF FUTURE WORK

- By considering the wind load, to determine the behaviour of structure.
- Analyze the behaviour of soil structures interaction and foundation design

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