COMPARATIVE STUDY OF FACTORS AFFECTING DYNAMIC AND EARTHQUAKE RESPONSE OF RCC FRAME STRUCTURE

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ABSTRACT: An earthquake occurs in the form of seismic waves due to sudden release of energy and results in ground shaking. During earthquake, seismic waves propagate through the soil which results in structural damage due to movements within the earth's crust. It impacts the behavior of interaction of components like building, foundation, underlying soils and also overall system behavior. When earthquake occurs, the behavior of a building depends on distribution of mass, strength and stiffness. Generally, the buildings are subjected to various types of forces throughout their existence. The forces can be static forces due to dead and live loads and dynamic forces due to earthquake. In this study, the analysis is carried out for seismic response of (G+12) residential building for zone-I, II, III and IV regions through response spectrum method and time history method in ETABS. The parameters likestorey displacement, storey drift and storey shear are observed for specified zones.

I. INTRODUCTION

Structural response to earthquakes is a dynamic phenomenon that depends on dynamic characteristics of structures and the intensity, duration, and frequency content of the exciting ground motion. Although the seismic action is dynamic in nature, building codes often recommend equivalent static load analysis for design of earthquake-resistant buildings due to its simplicity. This is done by focusing on the predominant first mode response and developing equivalent

Seismic analysis is a subset of structural analysis and is the calculation of the response of a building (or non-building) structure to earthquakes. It is part of the process of structural design, earthquake engineering or structural assessment and retrofit (see structural engineering) in regions where earthquakes are prevalent .As seen in the figure, a building has the potential to 'wave' back and forth during an earthquake (or even a severe wind storm). This is called the 'fundamental mode', and is the lowest frequency of building response. Most buildings, however, have higher modes of response, which are uniquely activated during earthquakes. The figure just shows the second mode, but there is a higher 'shimmy' (abnormal vibration) mode. Nevertheless, the first and second modes tend to cause the most damage in most cases.

A. OBJECTIVES

- To study seismic analysis of the multi-storey buildings (G+12) residential building for multiple seismic zones.
- To Study comparison of failure in multiple seismic zones for G+12 Residential building.
- To study proposing safety measures for G+12 Residential building for seismic zone.

II. LITRATURE SURVEY

Brajesh Kumar Tondon et al This paper describe about the response of building when it is subjected to seismic load , this response can be shown by story drift and base shear .seismic analysis has been performed on (G+8) building which is located in zone 2 & 4 using STAAD Pro software . Analysis has been performed according to IS 1893 PART 1 (2002).

Mr. S.Mahesh et al The behavior of G+11 multi-story building of regular and irregular configuration under earth quake is complex and it varies of wind loads are assumed to act simultaneously with earth quake loads. In this paper a residential of G+11 multi-story building is studied for earth quake and wind load using ETABS and STAAS PRO V8i .Assuming that material property is linear static and dynamic analysis are performed.

M B Vikram et al. These linear static analyses are carried out by considering severe seismic zones (zone-II, zone-III, zone-IV, and zone-V) and the behavior is assessed by taking types II soil condition. Different responses like bending moment, axial forces of various load combination and zones are studied. The seismic load has significant impact on bending moment and axial force

Rakshith G M et al The building model in the study has twenty one storey's with constant storey height of 3m. Effect

of lateral load on moments, axial forces, shear force, base shear, maximum storey drift and tensile forces on structural system are studied and also comparing the results of zone 2, zone 3, zone 4 and zone 5. Different values of seismic zone factor are taken and their corresponding effects are interpreted in the results.

Md. MajidRaza et al In this project we had analysed the (G+10) building for finding the shear forces, bending moments, deflections & reinforcement details for the structural components of building (such as Beams, columns & slabs) to develop the economic design, Finally we made an attempt to do Seismic analysis by both Static (Equivalent Lateral) and Dynamic(Response Spectrum Analysis) method for (G+10) residential building using ETABS Software tool.

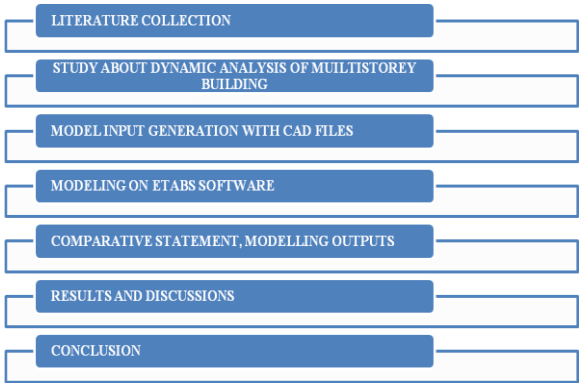
A. SUMMARY.

The findings of this literature are Different values of seismic zone factor are taken and their corresponding effects are interpreted in the results. The structural safety of the building is ensured by calculating all acting loads on the structure, including the lateral loads caused due to wind and seismic excitation. The structures need to have suitable Earthquake resisting features to safely resist large lateral forces that are imposed on them during Earthquake in different seismic zones, and also construction material, cost and effectiveness in minimizing Earthquake damage in structure. The seismic load has significant impact on bending moment and axial force.

III. METHODOLOGY OF WORK

The project study involved two stages. The primary data was gathered through a Literature survey targeted by web searches and review of eBooks, manuals, codes and journal papers. After reviewing the problem statement is defined and model preparation is taken up for detail study and analysis purposes. This project execution follows the flow chart given below:

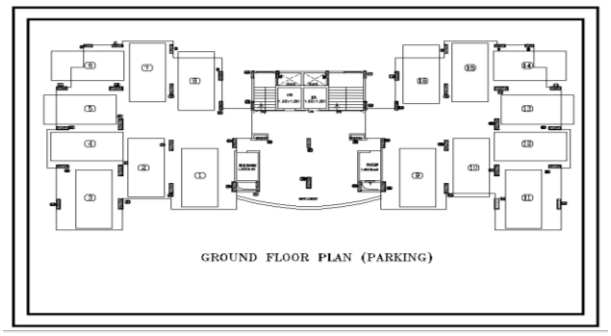
The following flow chart describes the layout of this project briefly:



The study is carried out for the behaviour of G+12 storied R.C frame buildings with a regular plan having rectangular, square and circular plan varying geometry. Floor height provided as 3.2 m. And also, properties are defined for the frame structure. Models are created in ETABS software. Various types of load are considered. For static behavior dead load of the building is considered as per IS 875 Part 1 and live load is considered as per IS 875 Part III, lateral load confirming IS 1893(part 1)2016. The three-dimensional reinforced concrete structures with G+12 storeys was analyzed by Response spectrum analysis using ETABS software. The analysis results will show study the seismic response of buildings in terms of storey shear, storey drift, storey displacement, time period, base shear, base moments, storey displacement, etc. find out compared within the considered configuration.

A. PROBLEM STATEMENT OF GEOMETRY

In this project, a G+12-storey structure of a rectangular building with 3 m floor to floor height has been analyzed Non-Linear Dynamic Analysis of multi-storey R.C.C Buildings using ETABS software in multiple seismic zones. The plan selected is Rectangular in shape. It is not the plan of any existing or proposed building but is an architectural plan. The structure has been analyzed for both static and dynamic wind and earthquake forces. Hard soil condition has been selected for the structure.



IV. RESULTS

A. PREPARE MODELING IN ETABS FOR ZONE I, II, III, IV

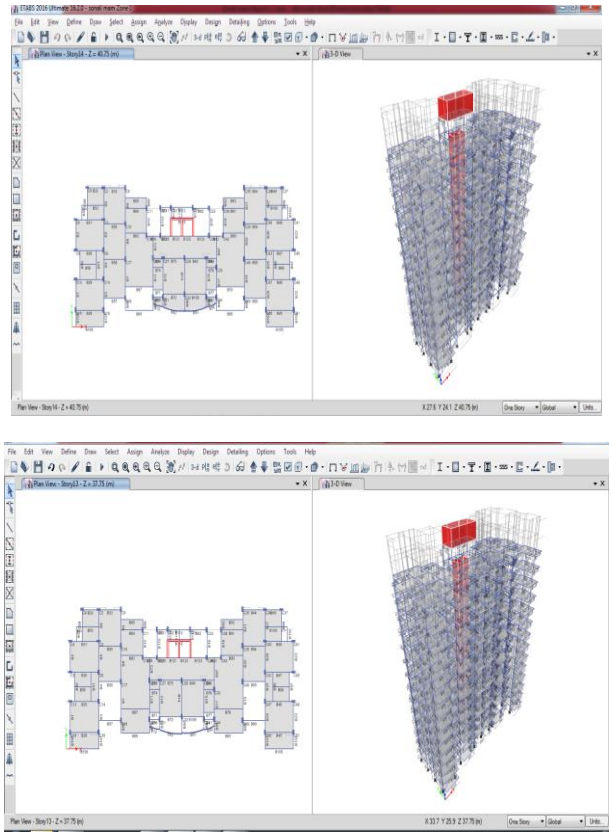
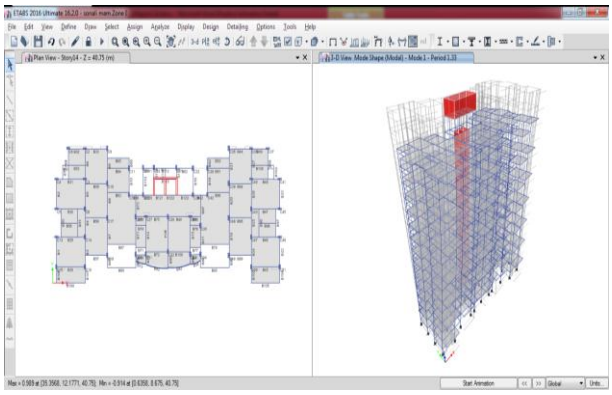
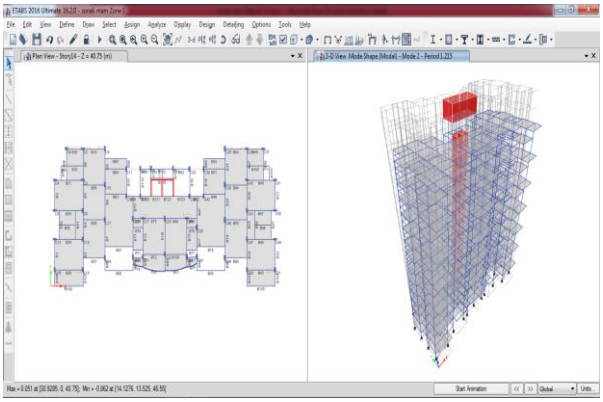


Fig 1 Prepare Model in ETABS

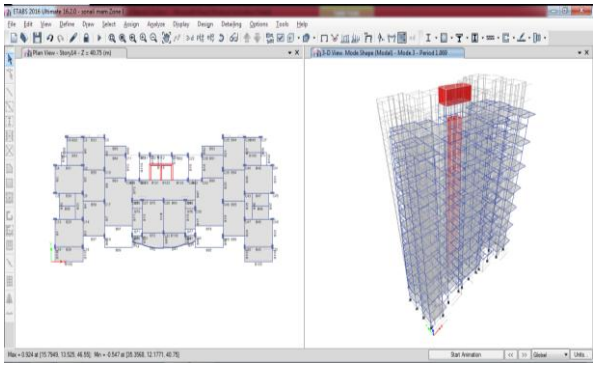
B.TIME PERIOD FOR ZONE I, II, III, IV



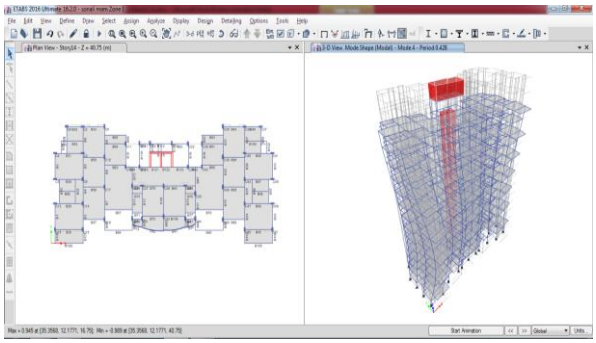
Mode Shape 1 for zone I,II, III, IV



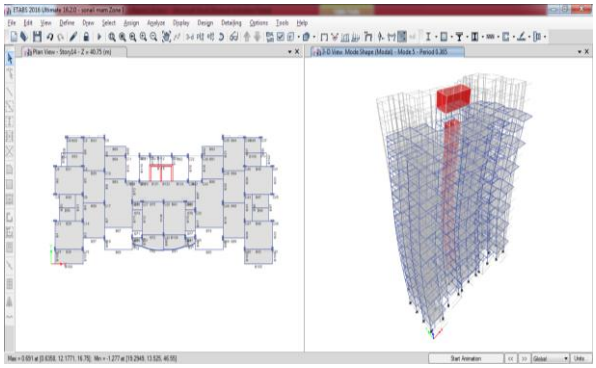
Mode Shape 2 for zone I,II, III, IV



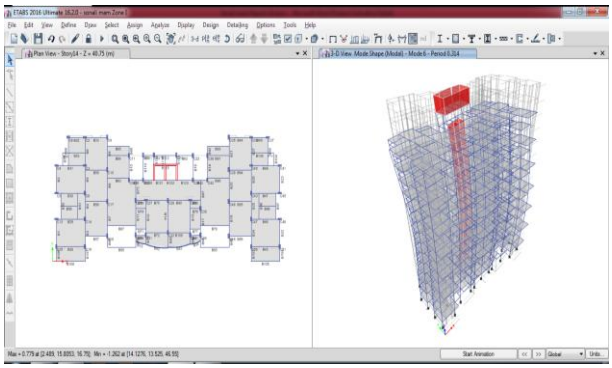
Mode Shape 3 for zone I, II, III, IV



Mode Shape 4 for zone I, II, III, IV



Mode Shape 5 for zone I, II, III, IV

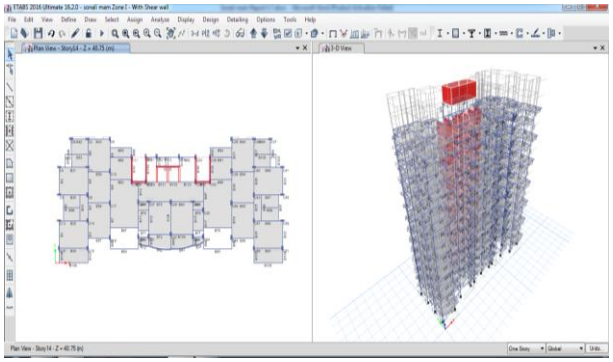


Mode Shape 6 for zone I, II, III, IV

MODE	TIME PERIOD
1	1.33
2	1.215
3	1.069
4	0.428
5	0.365
6	0.314

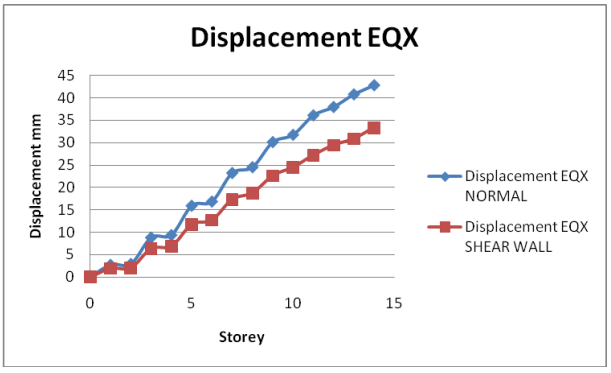
C. RESULTS AFTER PROVIDING SHEAR WALL FOR ZONE I

The maximum results for storey displacement, Storey Drift, and base Shear are in Zone I so in same model we provide more shear walls to reduce that same results.



Provide More shear walls for zone I

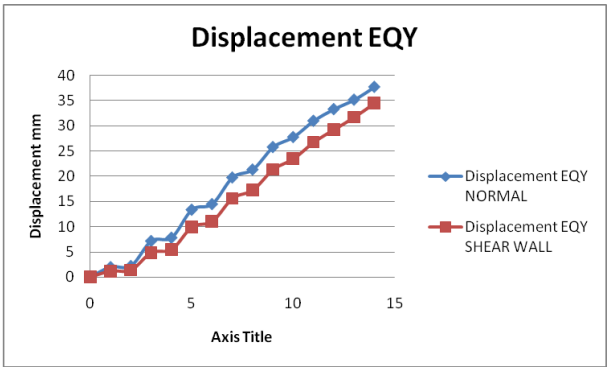
DISPLACEMENT EQX		
STOREY	NORMAL	SHEAR WALL
14	42.793	33.37
13	40.758	30.866
12	37.952	29.422
11	36.074	27.191
10	31.735	24.484
9	30.113	22.608
8	24.515	18.775
7	23.215	17.321
6	16.848	12.723
5	15.907	11.727
4	9.382	6.893
3	8.815	6.348
2	2.93	2.068
1	2.733	1.906
0	0	0



Above Graph shows the results for the Displacement for forces of Earthquake from X direction for zone I for normal

model and shear wall model from the above graph its conclude that the building after providing more share wall are reduce the results of the displacements by 25-30%

DISPLACEMENT EQY		
STOREY	NORMAL	SHEAR WALL
14	37.704	34.533
13	35.167	31.735
12	33.29	29.266
11	30.975	26.767
10	27.754	23.462
9	25.773	21.355
8	21.319	17.25
7	19.748	15.614
6	14.475	11.043
5	13.357	9.921
4	7.813	5.464
3	7.155	4.85
2	2.202	1.368
1	1.982	1.186
0	0	0



Above Graph shows the results for the Displacement for forces of Earthquake from Y direction for zone I for normal model and shear wall model from the above graph its conclude that the building after providing more share wall are reduce the results of the displacements by 25-30%

V. CONCLUSION

After the analysis G+12 RCC building for Zone I, II, III & IV the results conclude that the zone one required heavy design then IV, III And II Simultaneously The maximum results for storey displacement, Storey Drift, and base Shear are in Zone I so in same model we provide more shear walls to reduce that same results this all conclusion are conclude by following points

- The results for the Displacement for forces of Earthquake from X direction for zone I for normal model and shear wall model from the above graph its conclude that the building after providing more share wall are reduce the results of the displacements by 25-30%

- The results for the Displacement for forces of Earthquake from Y direction for zone I for normal model and shear wall model from the above graph its conclude that the building after providing more share wall are reduce the results of the displacements by 25-30%

VI. REFERENCES

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