Time History Analysis Of Irregular Rcc Building For Different Seismic Intensities

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Abstract---An earthquake is the result of a rapid release of strain energy storied in the earth crust that generates seismic waves. Structures are vulnerable to earthquake ground motion and damages the structures.In order to take precaution for the damage of structures due to ground motion, it is important to know the characteristics of the ground motion. The most important dynamic characteristics of earthquake are peak ground acceleration, frequency content, and duration. These characteristics play predominant rule studying the behaviour of structures under the earthquake ground motion.

A linear time history analysis overcomes all the advantages of modal response spectrum analysis, provided non-linear behaviour is not involved. This method requires greater computational efforts for calculating the response at discrete times. One interesting advantage of such procedure is that the relative signs of response quantities are preserved in the response histories. This is important when interaction effects are considered in design among stress resultants.

In present work topic deals with study of seismic behaviourof irregular building subjected to different ground motions, and analysis is performed using ETABS 2016 software package .

Keywords: Linear Time History Analysis, seismic responses, Irregular building,

1.INTRODUCTION

All over world, there is huge demand for construction of high rise buildings due to increasing population .Earthquake resistant design of engineering structures is one of the most important method of damage from future earthquake. The earthquake design of structure is based on the specification of ground motion of previous earthquake results. So earthquake resistant design of any important structure according to the seismic frequency is very important to overcame from damage. However the earthquake forces are different and un predictable .so the software tools need to be used for analysing structures under any seismic forces.

Earthquake develops differentintensities at different locations and the damage induced in buildings at these locations is also different according to the type of structure . Therefore it is Necessary to study the seismic behaviour of RC framed building for different seismic intensities.

The seismic intensities in terms of various responses such as base shear , lateral displacement.

Different types of analysis are used to identify the seismic resistance and behaviour of building under applied seismic frequencies.

The analysis can be performed on the basis of external applied loads ,applied structural materials and type of structure ,the analysis are classified as 1).Linear static Analysis 2).non linear static analysis 3)Linear Dynamic Analysis 4). Non linear Dynamic Analysis .

The Time history analysis is response of the structure including inertial effects, this is advanced to response spectrum analysis,

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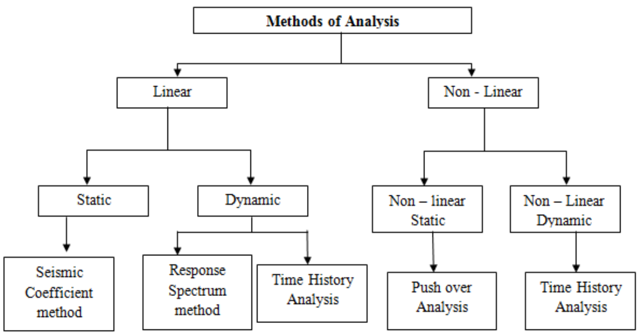
and gives base acceleration, displacement, and duration.

This is useful for very high rise structures to know the behaviour of structure under any seismic attacks. This analysis requires previous earthquake data to perform the analysis. It is a step by step analysis of response of structure under specified load that may vary with time.



2.MODELLING DESCRIPTION

The irregular structures may be due to the irregular distribution in their mass, stiffness along the height and strength of building. Those buildings are very complicated to analysis and design .The irregularities are two types, they are plan irregularities and vertical irregularities.

The plan irregularities are one of the important causes of damage during occurrence of an earthquake. Plan irregularity may occur due to irregular distribution of mass, stiffness and strength along the plan.

A G+5 story building is plan is selected for this study. ETABS software is used to create 3D model and perform the analysis. An irregular L shaped building plan is selected for analysis. The height of the structure is considered as 3 meters. All the beams and columns are modelled as frame elements. The slabs are modelled as shell elements. The geometry and dimensions are shown inbelowfig.

Live load on each floor = 2 kn/m^2

Column cross sections are considered as 300x600 mm

Beam cross sections are considered as 230 x 584 mm

Slab thickness is 125 mm,

Floor finish load – 1.5kn/m^2

Brick wall thickness are 230 mm and 115 mm ,

Modulus of elasticity of concrete-25000 N/mm^2 .

Seismic response reduction factor R=3

Seismic Zone factor Z=0.16

Soil type is considered as Medium.

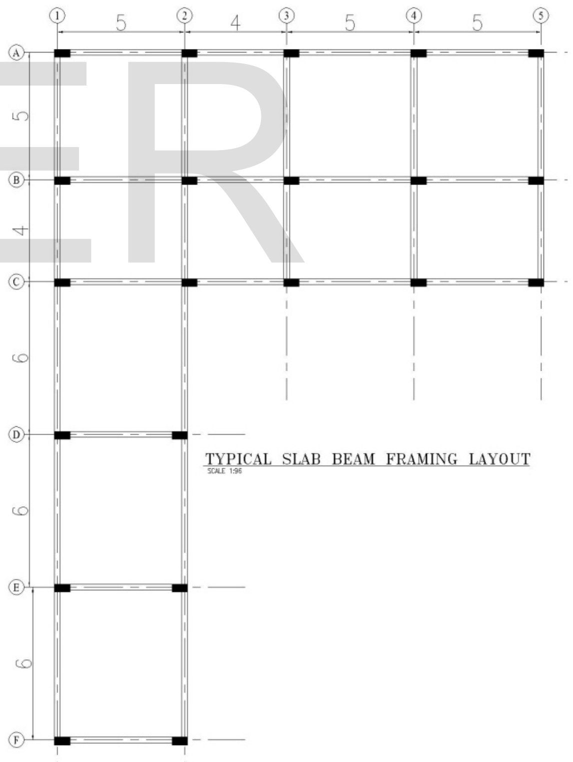


Fig. 1. Plan

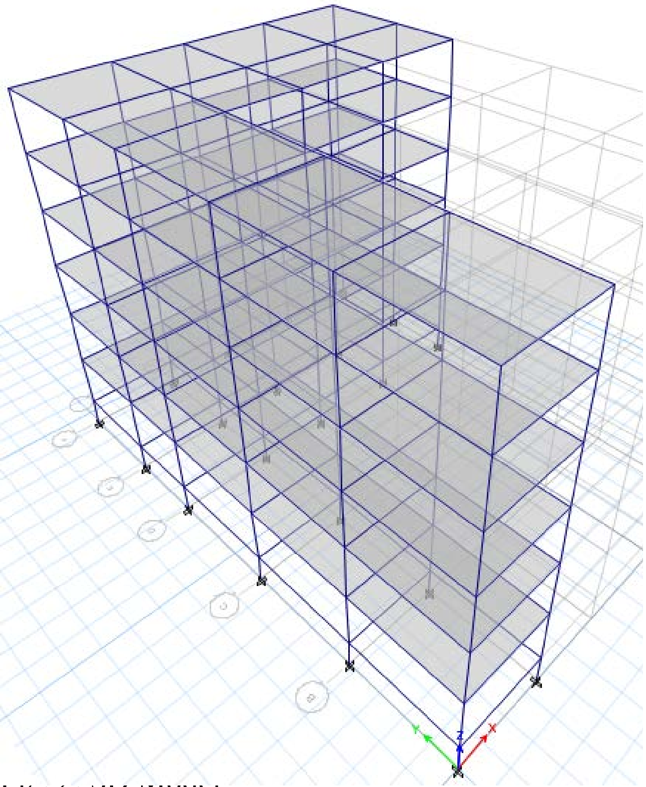


Fig. 2. 3D Model

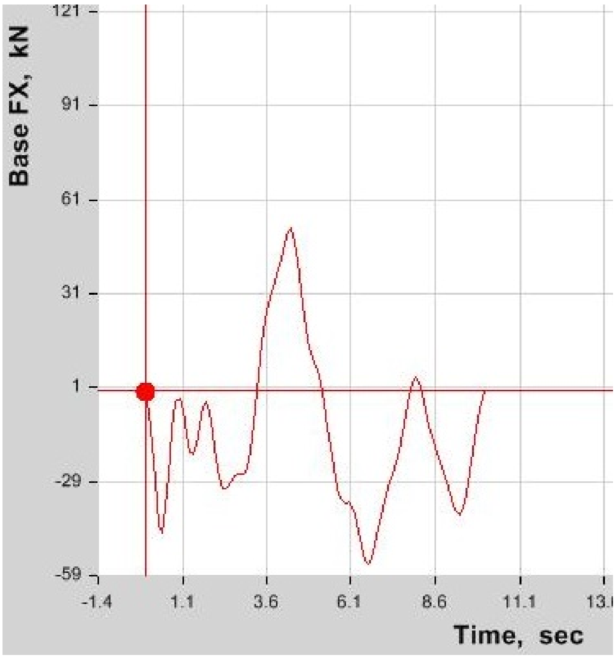


Fig.3. Bhuj,India Earthquake Result Along X , Direction (From Etabs Software)

TIME HISTORIES CONSIDERED FOR STUDY

s.no.	EARTHQUQKE	DATE	MAGNITUE
1.	Bhuj,india	26.01.2001	7.7
2.	El Centro(United States and Mexico)	18.05.1940	6.9

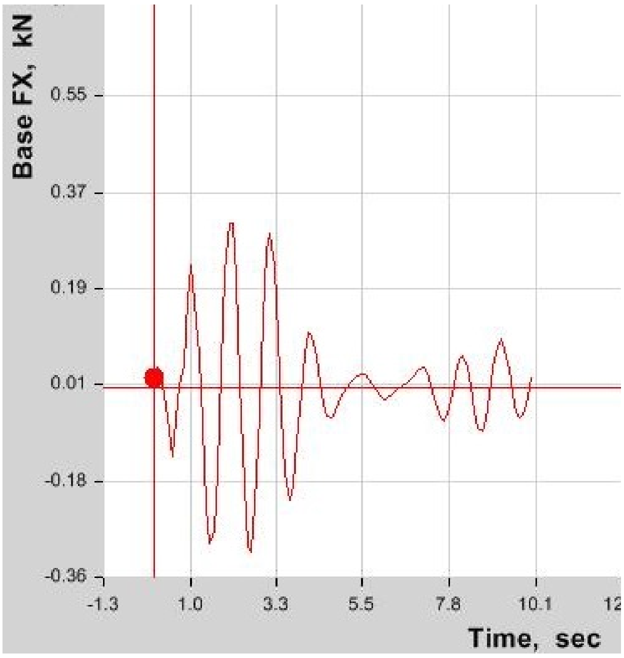


Fig.4.Bhuj,India Earthquake Result Along

Y--DIRECTION (from ETABS Software)

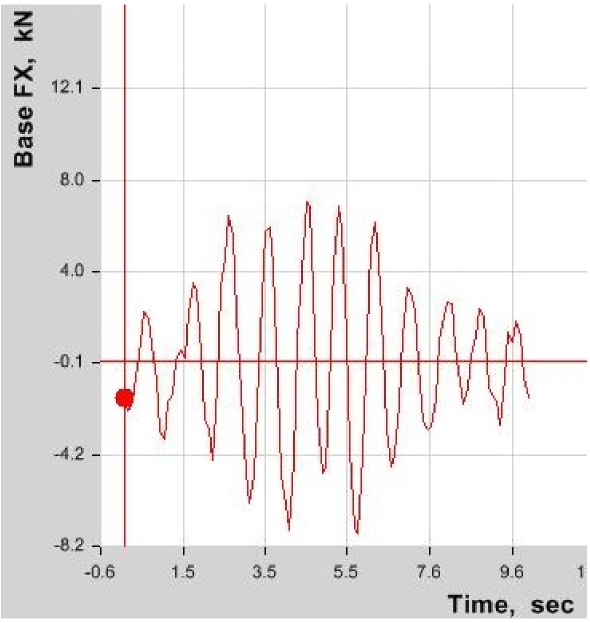


Fig.5. El Centro(United States And Mexico) Earthquake Result Along X--Direction(From Etabs Software)

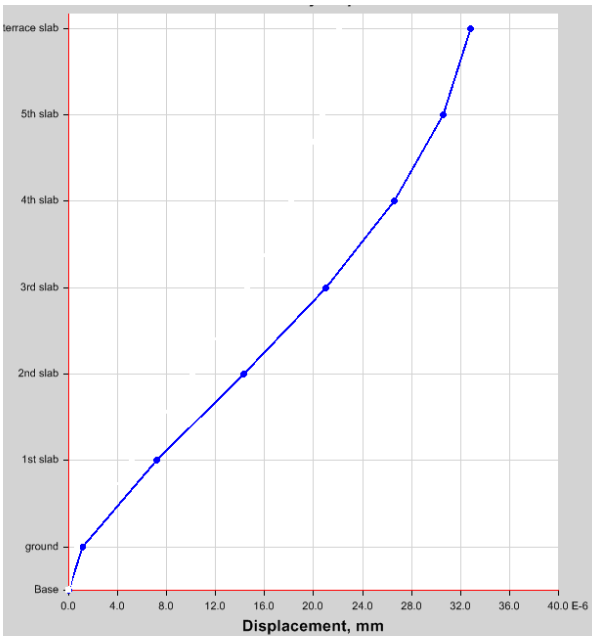


Fig.7.Maximum Story Displacement OfBhuj Earthquake

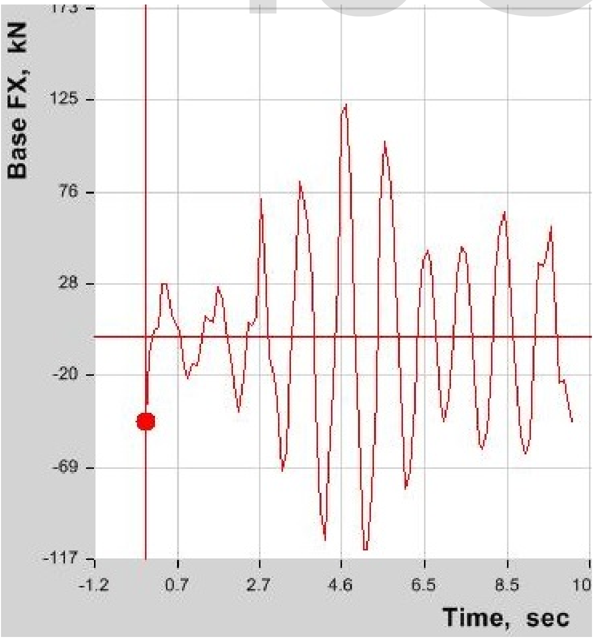
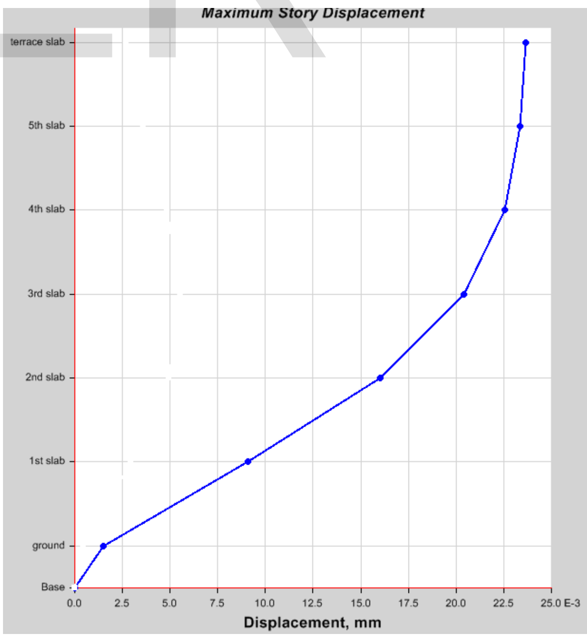


Fig.6. El Centro(United States and Mexico)Earthquake Result Along Y--Direction(From Etabs Software)



A

B

Fig.8.Maximum Story Displacement Of El Centro Earthquake

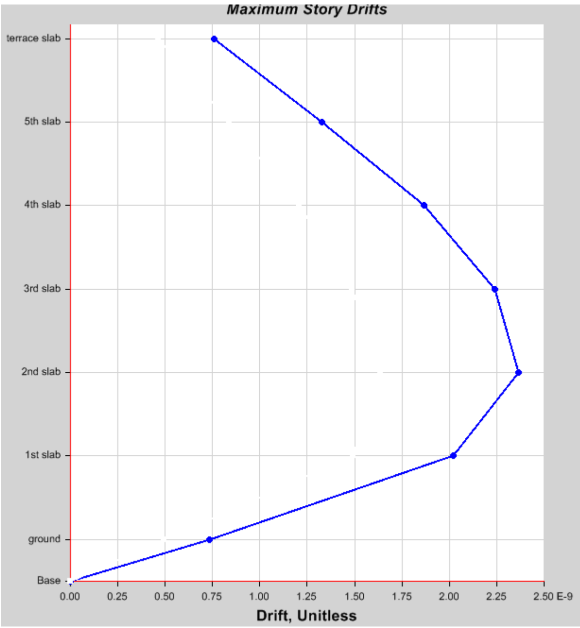


Fig.9.Maximum Story Drift Of Bhuj Earthquake.

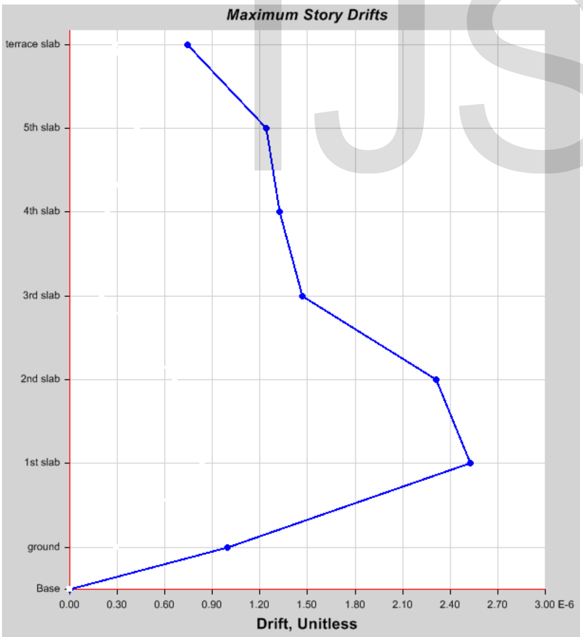


Fig.10.Maximum Story Drift Of El Centro Earthquake.

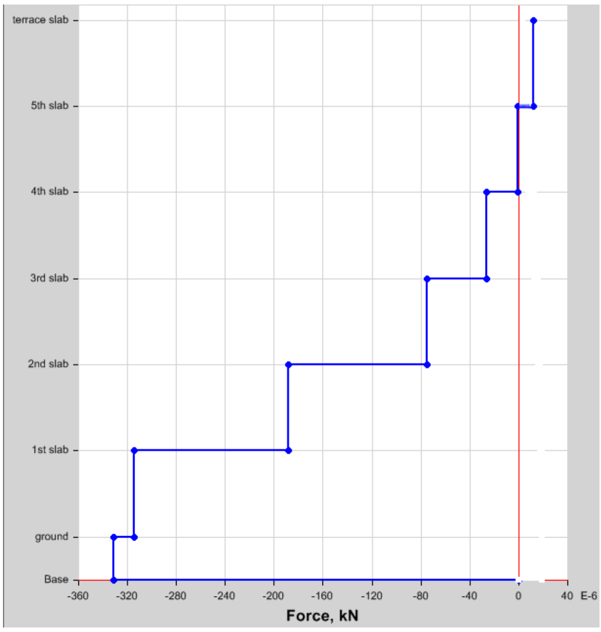


Fig.11.Maximum Story Shear Of Bhuj Earthquake.-X-Direction.

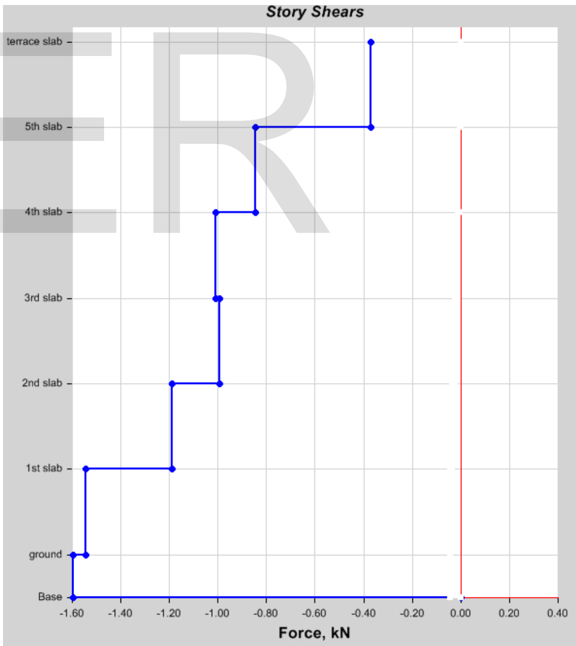


Fig.12.Maximum Story Shear Of ElCentro Earthquake.-X-Direction.

3.RESULTS

The above plan is analysed with linear time history analysis. The above Graphs represent the variation displacement and base shear results from the Analysis.

1. The story shear is more in ElCentro compared to Bhuj earthquake.
2. Maximum Story drift in Bhuj earthquake is located at 2nd slab and it reduces to 5th slab
   Maximum story drift in El centro is located at 1st slab level.
3. Displacement also having huge variance. In both results.

4.CONCLUSION

As compare to the high rise building, low rise buildings (irregular) also required some special care in planning and in design to resist earthquake forces.The mass of the building that is effective during earthquake shaking.The seismic mass distribution in irregular building along the plan is different, so it is very effective in lateral oscillation during earthquake.The buildings with irregularities also showed unsatisfactory results in both direction of buildings.This proves that irregularities in buildings are harmful for the structures.

From this study it is proved to prefer the plan irregularities to distribute the seismic lateral inertia force to various lateral load resisting systems in proportion to their lateral load resisting capacities.

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