Comparative Analysis Of Different Irregular Building With Regular Building

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Abstract – This study comprises state-of-art knowledge in the seismic response of vertically irregular building frame, During severe seismic shaking irregular building may suffer disproportionate damage or collapse that can be minimized by increasing robustness. The prime objective of this study is to find out the how irregular buildings shows there behavior when the seismic loads or effects with real time seismic data apply on the structure. Analysis is going to be done with finite element analysis using time history data in the E-TAB 2016 software, and in seismic zone IV.

***Key Words*: Verticle irregularity, time history analysis.**

1. INTRODUCTION

Presence of asymmertricity in the reinforced concrete increases seismic vulnerability; In areas in the word that experience a high frequency of the earthquake, considering irregularity is an integral part of the process of earthquake engineering or structural designing irregularities arise during an earthquake. Weakness in the structure can be caused by discontinuities in the mass, stiffness, or geometry. Vertical irregularity of a structure becomes the primary cause of failure during an earthquake. Zones with vertical irregularity are carefully evaluated and developed with the appropriate treatment when such structures are built in high seismic zones, such as zone IV or zone V. Soil structure interaction's seismic consequences must be taken into account. Three models—Model 1 (regular), Model 2 (story-1, without slab), and Model 3 (story-1, slab with double thickness) were taken into consideration for analysis in the current study.

The comparative analysis of regular and irregular structure will be based on the base shear, story stiffness, Story displacement & drift analysis

Earthquake is the greatest anticipated lateral force that results from ground acceleration and depends on the kind of soil. Story Stiffness, or the total stiffness of all permanent members participating in a certain story.

Here we are going to compare and analyze the different type of buildings with there stiffness, base shear, story displacement and drift index values. In modeling we used the E-TAB 2016 for structural seismic analysis, we also used the Finite Element Method with the Time History input data. When it comes to irregular structure design Time history method gives the best results for lateral force distribution with actual ground acceleration data that has been experienced in the past

2. OBJECTIVE

Main objective of the paper is to know the behavior of the structure under different parameters

- To know the behavior of the structure with different geometric conditions
- To know the story stiffness of the structure for both regular and irregular
- To know the base shear conditions in the both the cases
- To find out the Story Displacement difference between symmetric & asymmetric building
- To show the differences in Drift index for both cases

3. METHDOLOGY

The present work is carried out to understand the behavior of structure, when we use the irregular building instead of regular building. There are step by step procedures involved in the modeling and analysis of the structure

Irregularities in buildings

Irregularities can be defined in two major parts, they are:

1- Plan irregularity

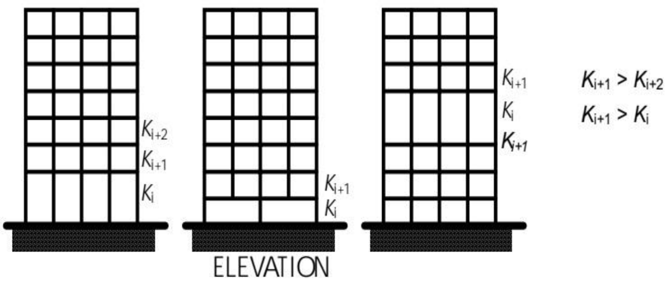
2- Vertical irregularity

In plan irregular buildings, five types irregularity present, they are:

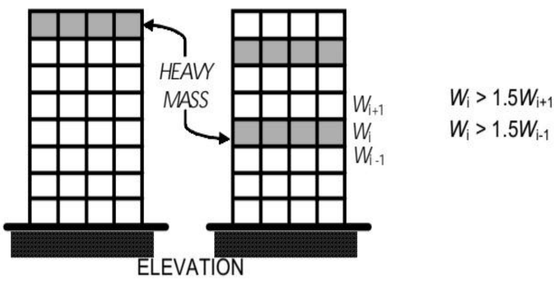
- Torsion Irregularity
- Re-entrant Corners.
- Diaphragm Discontinuity.
- Out-of-Plane Offsets.
- Non-parallel Systems.

In vertical irregular buildings also five types rregularity present they are:

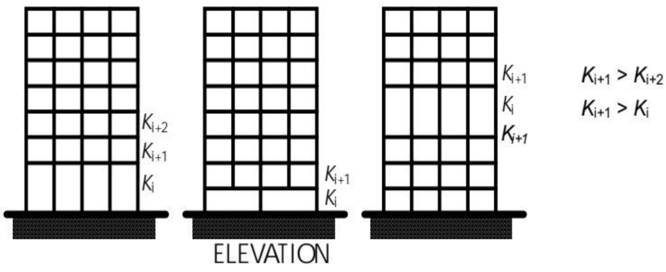
- Stiffness. Irregularity
- Soft Storey
- Extreme Soft Storey.
- Mass Irregularity.
- Vertical Geometric Irregularity.



4A STIFFNESS IRREGULARITY (SOFT STOREY)



4B MASS IRREGULARITY



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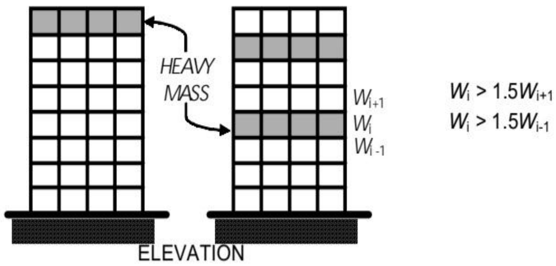

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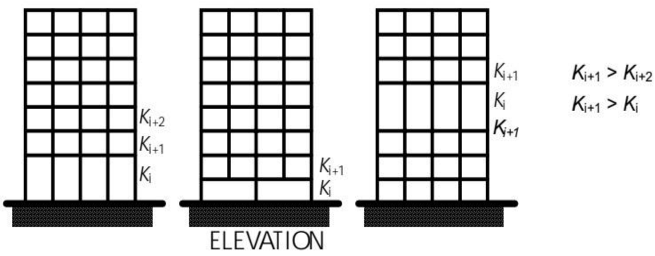

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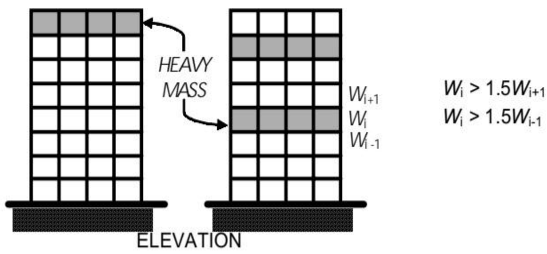
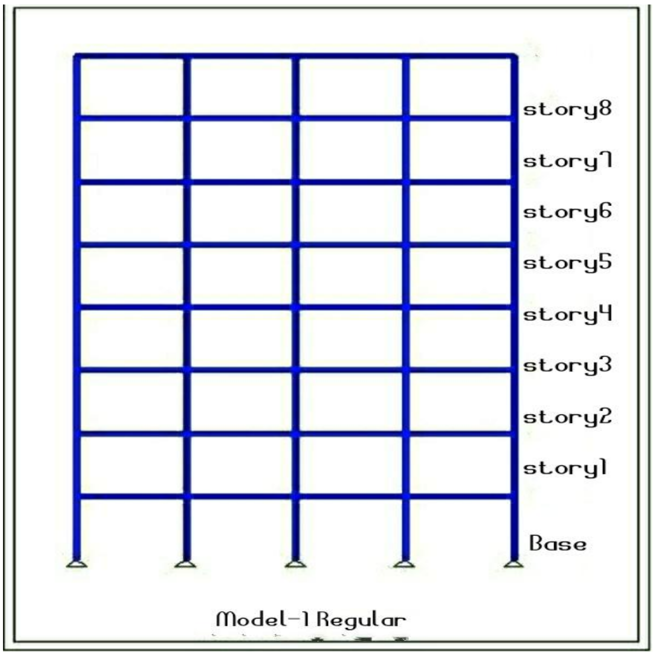
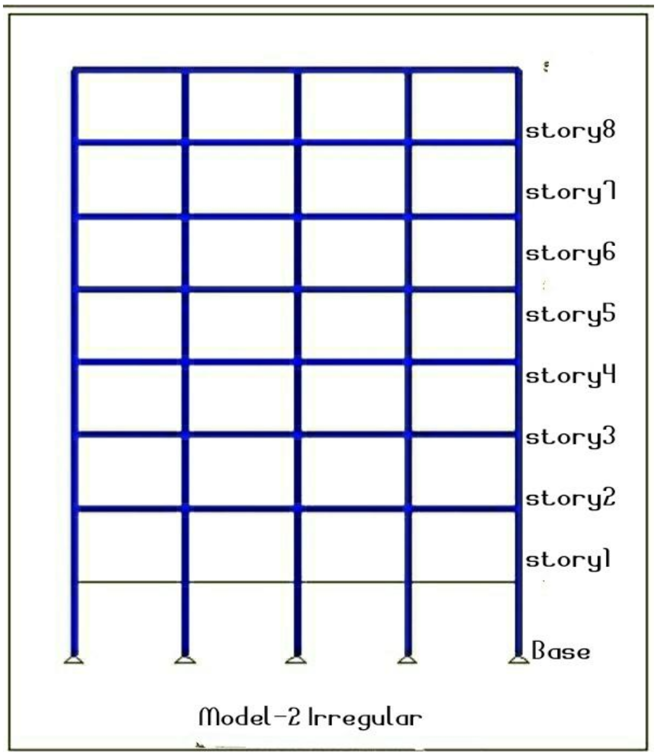


4B MASS IRREGULARITY

Modelling

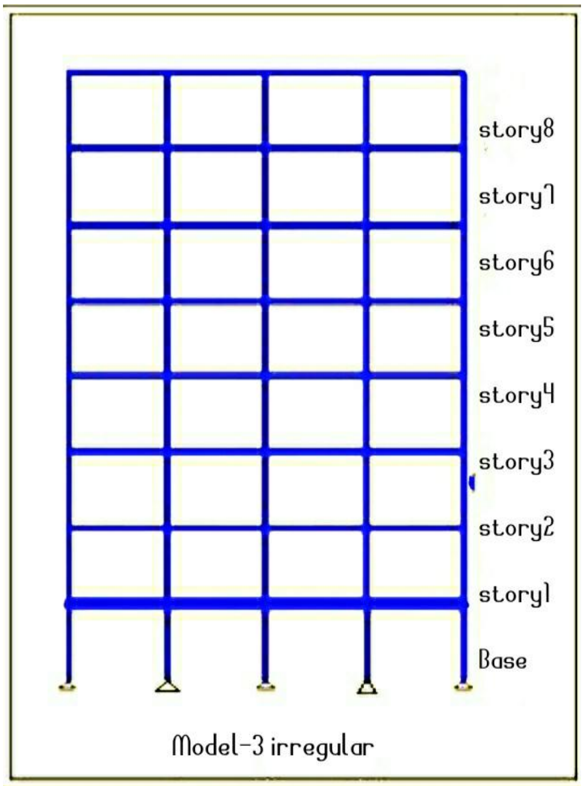
For modelling and anlysing E-TAB 2016 software has been used , here I have been created three model having 9-story building with model Type-1 Regular bulding, Model type-2 Irregular building have no slab at story 1, Model Type-3 irregular building with double depth of slab on story 1





Structural Properties :-

Plan dimension	16 X 15 m^2
No. of stories	9
Floor to floor height	3000 mm
Beam size	250X500 mm
Column size	450X450 mm
Thickness of slab	150 mm
Zone	IV
Zone factor	0.24 (IS 1893:2016)
Importance factor	1 (IS 1893:2016)
Response reduction factor	5 (IS 1893:2016)
Grade of concrete	M30
Grade of steel	Fe415
Density of concrete	25kN/m^3



Some of loading properties at building is describe below.

There are various type of loading properties used in the structure are as follows

Dead load of slab	3.75 kN/m^2
Floor finish load	1.0 kN/m^2
Roof finish load	1.0 kN/m^2
Live load	3.0 kN/m^2 (IS 1893:2016)

There is one more fundamental to be added for valuable contribution i.e. Time History Data to be used for seismic valuation

Time history data is always taken from the past experience of the seismic wave and that help in analyzing the real time valuation of structure designing

TIME HISTORY DATA

Depth (Km)	46.0
Magnitude	7.8
Region	Iran-Pakistan-Border-Region

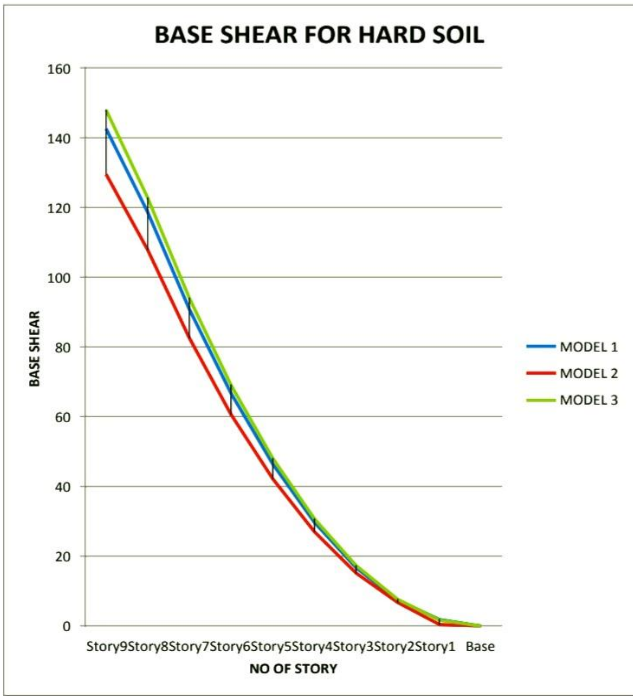
All details taken from IMD

Station Code	DCE
Station Lat.	28.795 N
Station Long.	77.118 E
Station Height (m)	208.0
Site Class	CVs30 between200m/sec to375m/sec
Record Time	16.04.2013 10:49:13.829
Sampling Rate	200Hz
Record Duration	169.970Sec.
Direction	E-W (E-positive)
Max. Acceleration	1.521cm/sec^2

4. RESULT & OBSERVATIONS

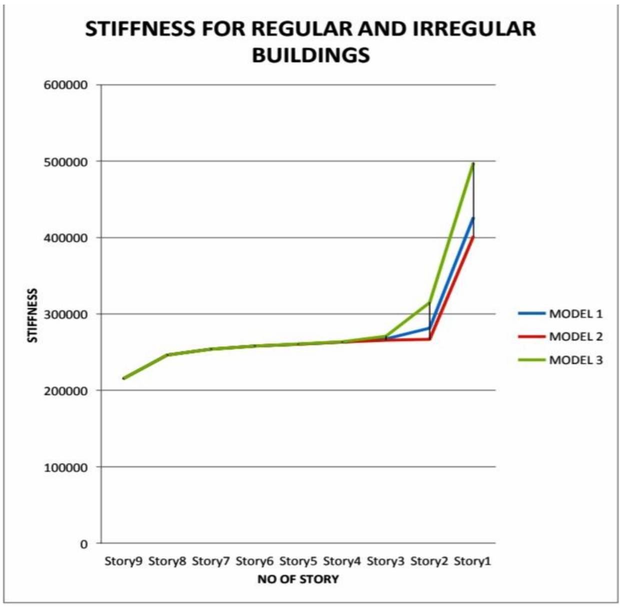
4.1 STIFFNESS VALUE FOR REGULAR & IREGULAR BULDINGS

As per observation of graph results shows that stiffness in the irregular building with double depth of slab at story 1 is 16.74% is more than regular building (model 1) & 23.92% more than the irregular building with no slab on story 1 (model 2)



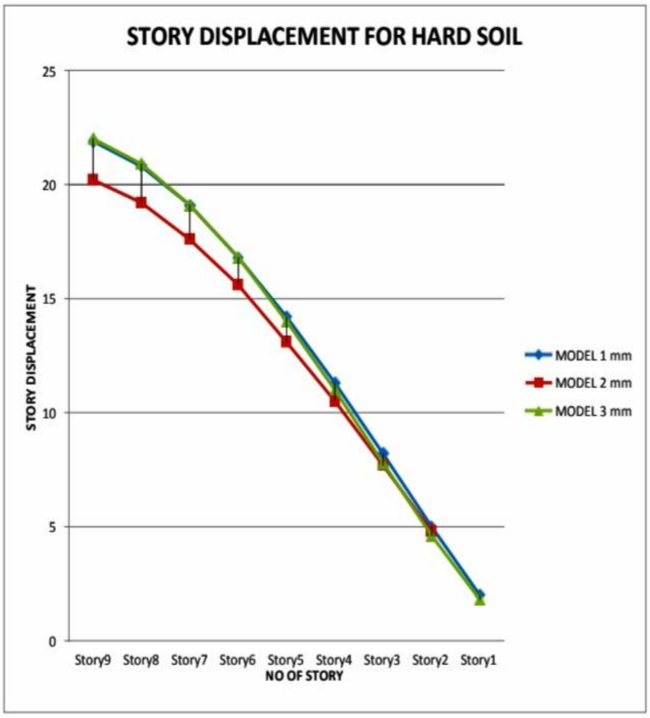
4.2 BASE SHEAR VALUE FOR HARD SOIL

As per observation of graph results shows that base shear in the irregular building with double depth of slab at story 1 is 3.80% is more than regular building (model 1) & 14.23% more than the irregular building with no slab on story 1 (model 2)



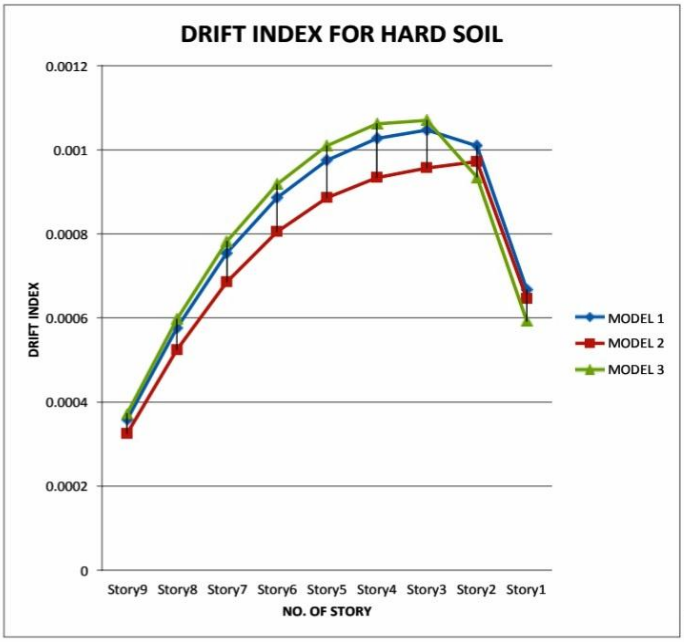
4.3 STORY DISPLACEMENT VALUE FOR HARD SOIL

As per observation of graph results shows that story displacement in the irregular building with double depth of slab at story 1 is 7.76% is more than regular building (model 1) & 36.41% more than the irregular building with no slab on story1(model2)



4.4 DRIFT INDEX VALUE FOR ROCK/HARD SOIL

As per observation of graph results shows that base drift index in the irregular building with double depth of slab at story 1 is 12.66% is less than regular building (model 1) & 9.12% less than the irregular building with no slab on story 1 (model 2)



5. CONCLUSIONS

- As we all know that base shear on super structure is all depend on the soil condition (stiffness of soil) as per observation maximum value of base shear gives in model -3 and model-2 shows lowest values than the model-1 & Model-3

  Maximum value of base shear will be found at peak height of the structure , also base shear decreases as the stiffness of the soil decreases

- As we know story stiffness is the sum of stiffness of all permanent member present, as per observation maximum value of base shear gives in model -3 and model-2 shows lowest values than the model-1 & Model-3

  Maximum value of stiffness is observed at the base of the structure

- As we know displacement of structure is observe with reference to base , as per observation maximum value of base shear gives in model -3 and model-2 shows lowest values than the model-1 & Model-3

- As per observations drift index in the irregular building with double depth of slab shows lowest value for drift index and regular building shows lesser value than the irregular with no slab on story 1, here model 2 shows lowest value among all of them

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