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SEISMIC EVALUATION OF HIGH RISE BUILDING WITH VERTICAL IRREGULARITIES BY PUSHOVER ANALYSIS

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Abstract- **During earthquake motion. The seismic behavior depends upon the strength, mass, and stiffness are distributed in both horizontal and vertical planes. the buildings structural damage was severe the frame is caused due to the discontinuity in the stiffness mass and strength between the alongside stories. The same type of discontinuity is vertical geometric irregularity which is due to the irregular building configuration in vertical plane so there is to know the seismic response of building modals in different structural irregularities.**

Non-linear static (pushover analysis) which is used for Investigation. The purpose of study doing nonlinear static (pushover analysis) by conventional design methodology G+12 High rise buildings this work shows seismic performance and behavior of building frame with and without vertical irregularity in terms of base shear, story shear, story displacement the performance point of all models are considered also found that irregularity in assessment of the structure decreases the performance level of building there is also reduces in deformation or displacement of the structure. all the models analyzed by using ETABS and design as per IS 456:200 and 1893:2016

Keywords— **Pushover Analysis, type of irregularity, lateral displacement, story shear, Base shear**

I. INTRODUCTION

Non-linear static analysis (Pushover Analysis) is a popular technique for evaluating Rigid strength and deformation demand in the building and for find out structure weakness its for most benefit is that make easy to the structural Designer to acknowledge main reaction quantities and to use Engineering discernment to change suitable the strength and deformation demand and capacities that control the earthquake response near to failure. The important results of the non-linear Analysis are in the form of a force displacement curve called Pushover curve. it is plot of the base shear (total lateral load) versus the lateral displacement At some point of the roof level including all the stages of lateral load/displacement increment.

The important and easy method to find out the non-linear behavior of a building in earthquake loads. it is most famous technique to find out the failure in structure at what place really occurs. In this process Pushover Analysis method to find out solidity of a building far away its elastic limit near to its ultimate strength in the post elastic range. this process also find potential weak places in the structure, with continuously trace of the no of damages of each and every member of the building by use of plastic hinges.

The simplified Method for the earthquake assessment of buildings, which story for the rigid behavior, normally use the consequence of static non-linear analysis to described the rigid performance of the building currently, for this cause, the non-linear static procedure (NSP) or Pushover Analysis defined in FEMA-273, STC-40 documents are used. However, the method requires indubitable approximation and simplification that there will always be some degree of in amount of seismic demand compulsion of Non-linear analysis.

II. OBJECTIVE

In present study detailed evaluation of behavior of High rise RCC frame building under earthquake loading has been implement. The main aim of present investigation is to incorporate Capacity Design Concept to the Conventional Design Method and obtain appropriate strength hierarchy in the RCC b are frame building to know the seismic performance of the structure a Non-linear Static analysis (Pushover) is carried out. The parameter like Displacement Response and Base shear were targeted to study in detail.

III. MODELING

Non-linear static (Pushover Analysis) by using ETABS software analyzed to check the seismic performance of G+12 RCC buildings frame under the earthquake loading with vertical irregular, regular and plan irregular models comparative study of structural parameter like Base shear, Story drift and Story Displacement of RCC High rise buildings. All the parameter use as per IS 1893-2016.

3.1.1 Base Model (Model-M01)

This is the basic and regular building Model has 4 bays on both sides. the building is 12 stories the typical story Height 4m ground floor height is 3m. the total Building breadth is 5m. the primary specification of the structure are.

Preliminary Assume details of G+12 building Models

Sr.No	Contents	Description
1	Type of structure	High rise rigit joint plane building(RC moment resisting frame)
2	Seismic Zone	II
3	Zone Factor	0.10
4	Number of storey	G+12
5	Floor Height	4m
6	Base Floor Height	3m
7	Infill wall	230 mm thick wall
8	Marerials	Concret (M25) and Reinforcement Fe415
10	Size of Column	550mmX550mm
11	Size of Beam	550mmX350mm
12	Depth of Slab	150mm
13	Specific Weight of RCC	25KN/m3
14	Type of Soil	Medium Soil
15	Response Spectra	As per IS 1893:2016 for 5% Damping
16	Importance Factor	1

With the above earthquake data for modeling the plan, elevation & 3-D view of the base plan as shown below. all dimensions are in mm.

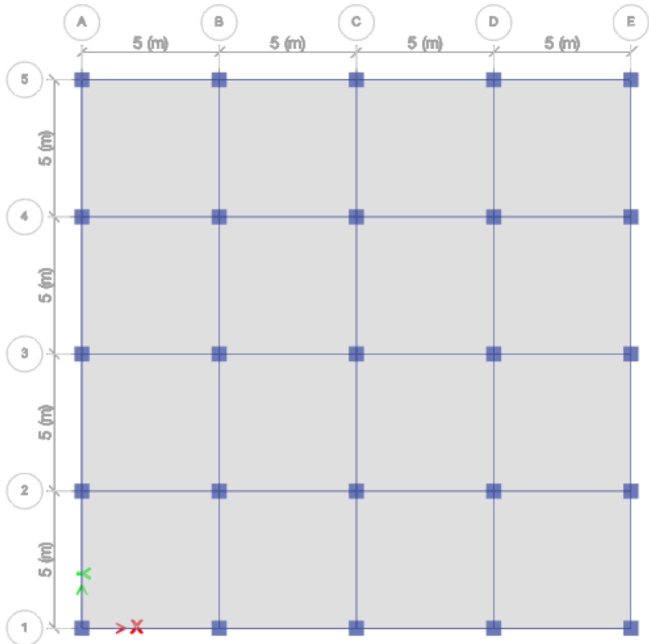

Fig 01 BASE PLAN

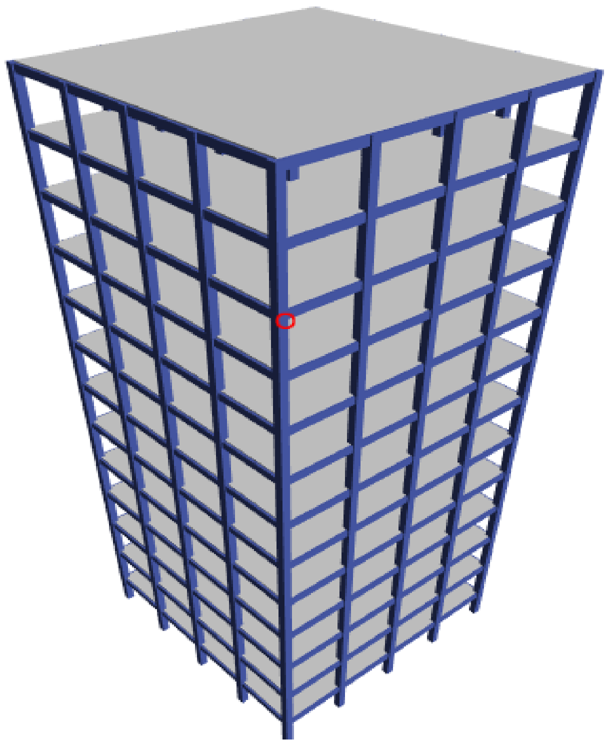

Fig 02 3D view of base fram Model (M-01)

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3.1.2 . Model with Geometric Irregularity

The building Model is irregular to understand the behavior of mass irregularity on vertical geometry. Unsymmetrical building the geometry is change with decreasing the no. of bays. In X-direction vertically downwards, as per IS 1893-2016 the other building parameter is same.

Sr. No	Designation	Type of Frame	Percentage of irregularity
1	Model 01	Regular	-
2	Model 02	Irregular	300%
3	Model 03	Irregular	400%
4	Model 04	Plan Irregular	400%
5	Model 05	Plan Irregular	300%

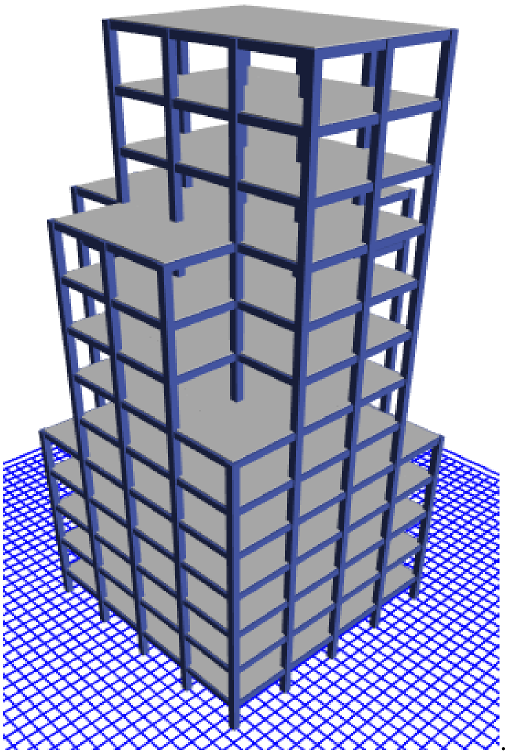


FIG. 04 3D VIEW OF MODEL 02

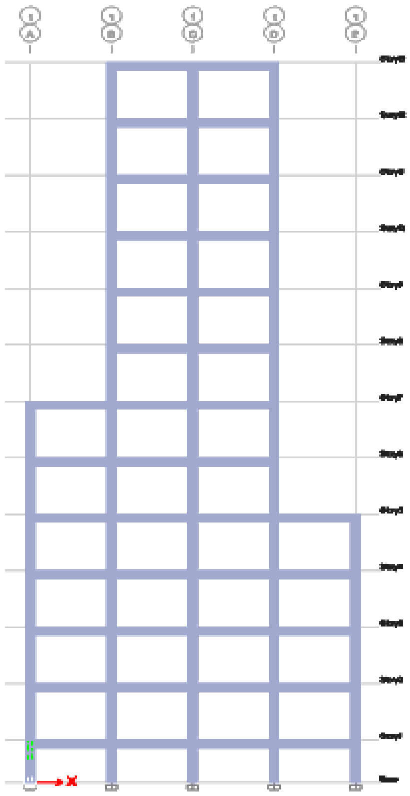


Fig. 03 ELEVATION OF MODEL M02

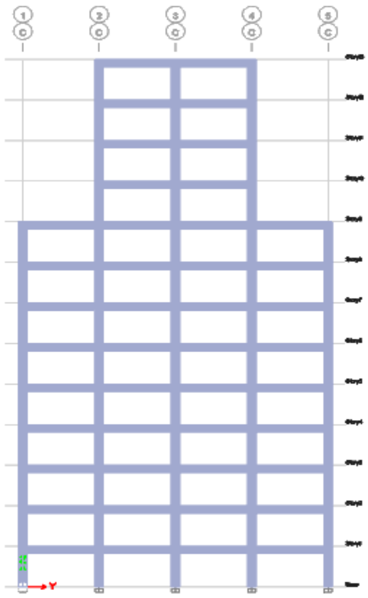


Fig. 05 ELEVATION VIEW OF MODEL 03

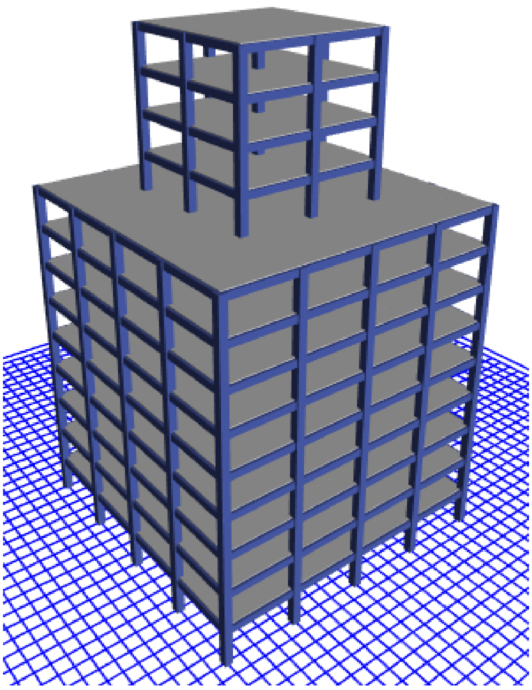


Fig. 06 3D VIEW OF MODEL 03

3.1.3 Base Model With Plan Irregularity

The base Model having The Plan irregular in this Moldel Both X and Y direction 2 bays reducing .the shape of the building is H shape. the typical storey height 4m and bottom storey height is 3m.the bay width is 5m.

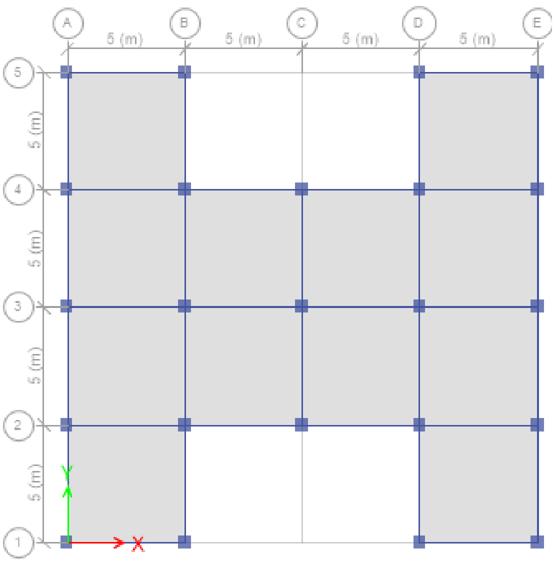


Fig. 07 BASE PLAN OF MODEL 04

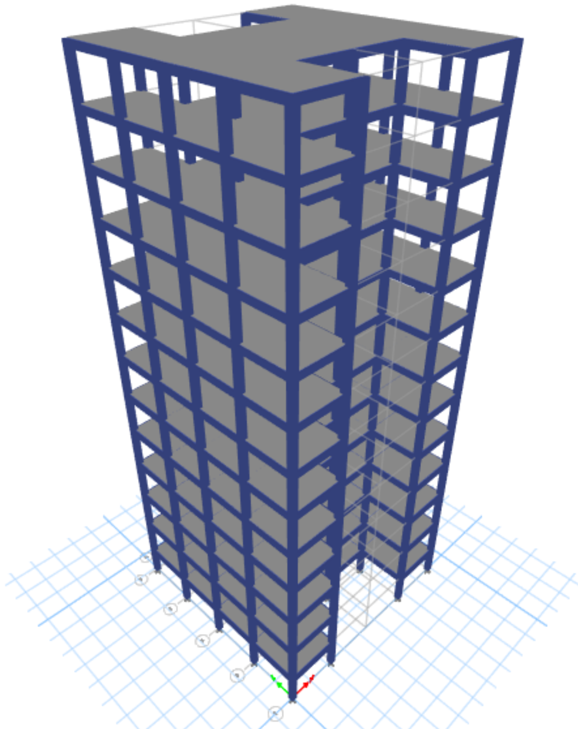


Fig. 07 3D VIEW OF MODEL 04

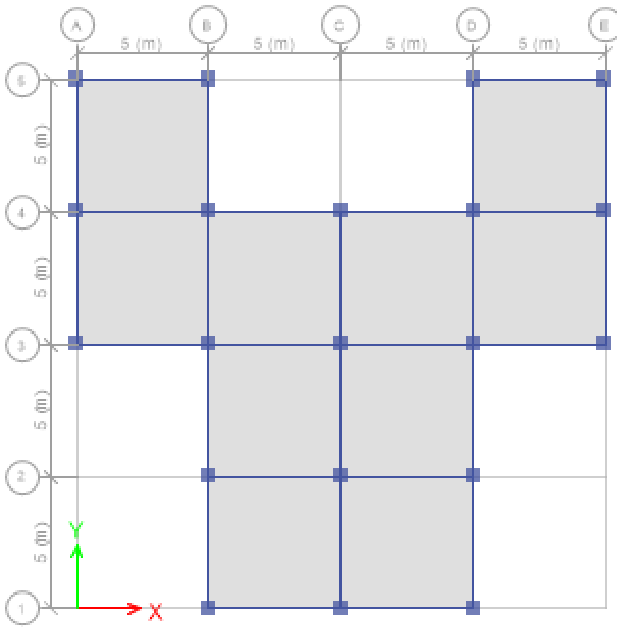


Fig. 09 BASE PLAN FOR MODEL 05

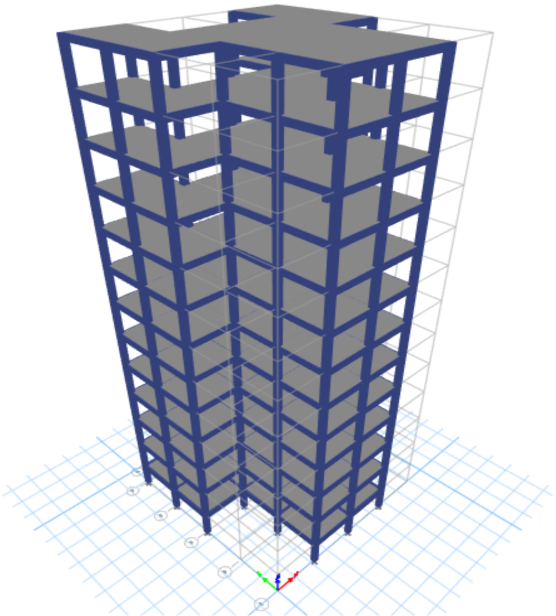


Fig. 10 3D VIEW OF MODE 05

IV. RESULTS AND DISCUSSION

Analyz of G+12 stories frame model with and with and without vertical irregularity is done with the help of Etabs software, After analysis all model results comes out ,bare frame models Regular building and geometric irregularity are compared. After comparision of that results comes out effect of vertcal irregularity is as bvelow.

4.1 Linear analysis
4.1.2 Lateral Displacement

As percentage irregularity changes the Lateral displacement widely increases..

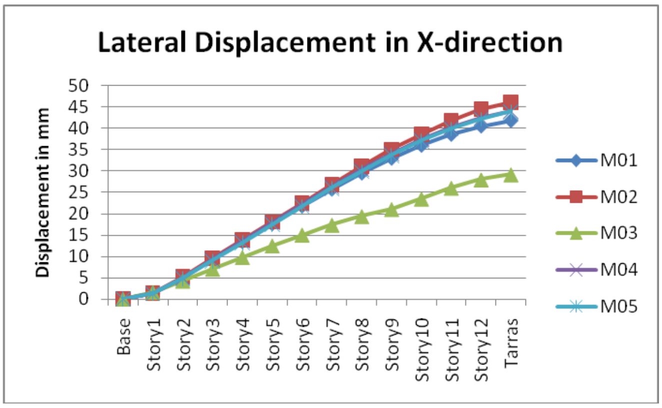


Fig.11 Lateral Displacementin X-direction

The regular frame shows the displacement of 1.34 but due to change in vertical irregularity it increases 1.41. In case of building with vertical irregularity, the maximum displacement is occurs compare to without irregularity here minimum storey displacement occurs in regular and plan irregular structure.

4.1.2 Inter storey Drift

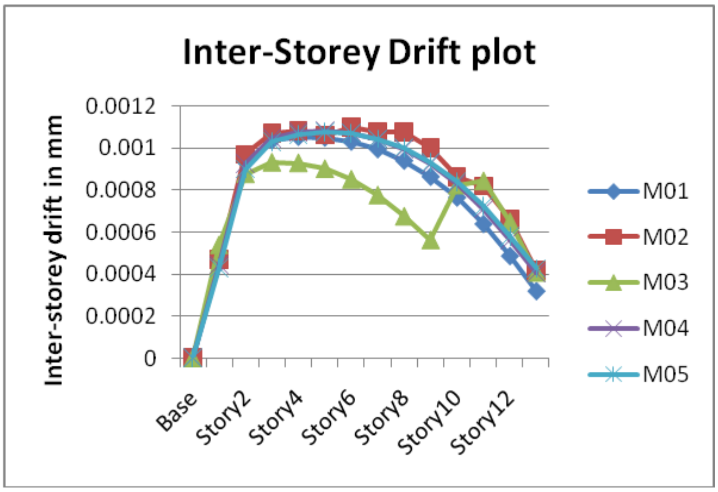


Fig 12 Inter-storey drift plopt

The change in Percentage of veretical irregularity cause change in storey drift, as the percentage increases in storey drift for irregular structure in all buildsing model maximum storey drift occurs in irregular structure.

4.1.3 Storey Shear

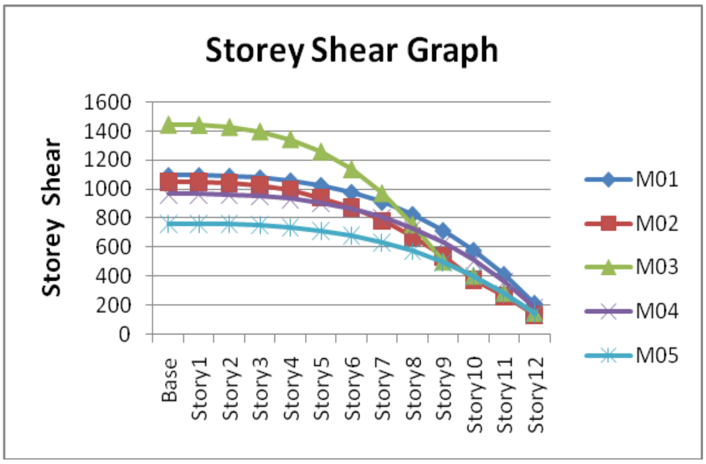
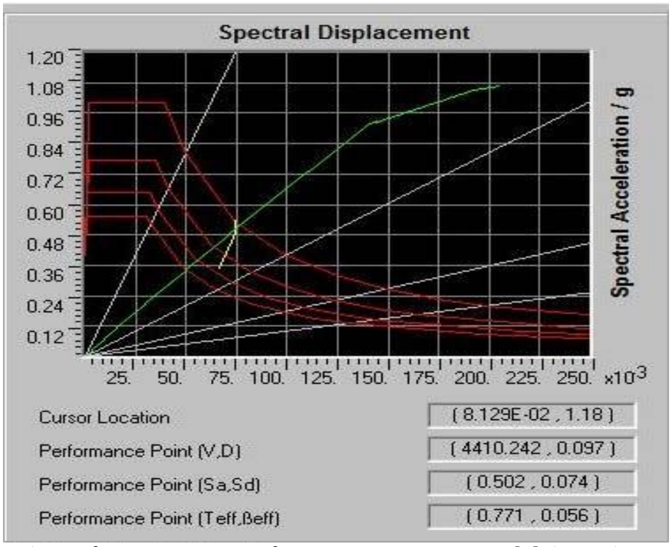


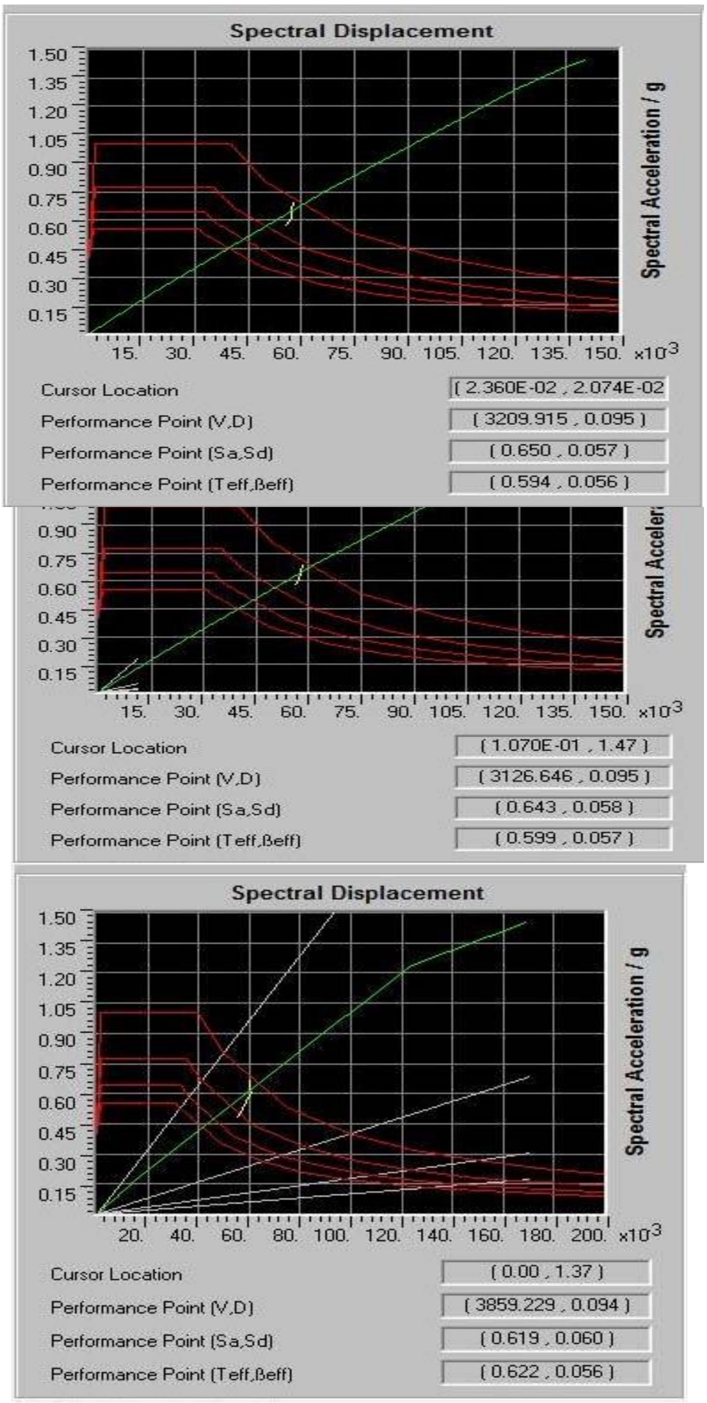
Fig 13 Storey Shear Graph

After analyze all building structures. Results comes out that there is increase in storey shear for irregular structure as compare to the regular structure. for all building models maximum storey shear occurs for irregular structure.

3.2Push-Over results

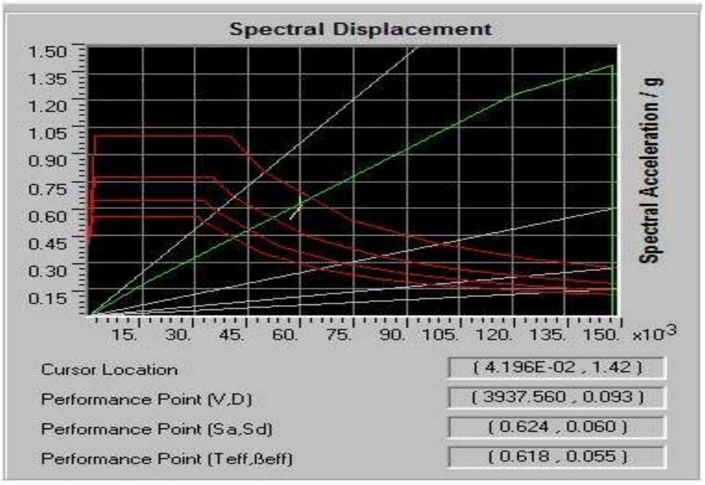


A) Performance point of Base Bare Frame Model (M-01)



B) Performance point of Base Bare Frame Model (M-02)

C) Performance point of Base Bare Frame Model (M-03)



D) Performance Point of Base Bare Frame Model (M04)
E) Performance Point of Base Bare Frame Model (M05)

Pushover Results

Frame Type	G+12 storey	G+12 storey
	Performance Point X (kM)	Displacement X (m)
Bare Frame (M-01)	4410.242	0.097
Bare Frame (M-02)	3859.229	0.094
Bare Frame (M-03)	3126.646	0.095
Bare Frame (M-04)	3937.560	0.093
Bare Frame (M-05)	3209.915	0.095

V. CONCLUSION

G+12 building structure with and without vertical irregularity buildings are Analyzed using Etabs software and following conclusion below based on above investigation.

1. From the results of G+12 stories building with vertical irregularity undergoes maximum storey displacement as compare to the building without vertical irregularity.

2. The change in Percentage of veretical irregularity cause change in storey drift, as the percentage increases in storey drift for irregular structure in all buildsing model maximum storey drift occurs in irregular structure.

3. Increase in storey shear for irregular structure as compare to the regular structure. for all building models maximum storey shear occurs for irregular structure.

4. From Above analysis we can see the there is minimum storey shear in plan irregular structure as compare to other models.

5. the analysis proves that the regular building has more lateral load carrying capacity as compared to building with vertical irregularity.

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Standard Codes:

1) BIS, IS 456:200, - Plain and Reinforced concrete code of practical Bureau of indian Standards, Fourth Revision.

2) BIS, IS 1893 (Part 1): (2002), - Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, Fifth revision.
3) BIS, IS 875 (Part 5): 1987,- Code of Practice for design Loads (other than earthquake) for buildings and strucres, Bureau of Indian Standard, Second revision.